# INDUSTRIAL MEDICINE AND SURGERY

## INDUSTRIAL MEDICINE

### *The International Journal of Medicine in Industry*


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HEARING LOSS IN RELATION TO INDUSTRIAL NOISE-EXPOSURE ..... 451
*William Grings, Ph.D., Anne Summerfield, Ph.D., and Aram Glorig, M.D.*

MANAGEMENT OF ACUTE HEAD INJURIES ..... 459
*Leonard T. Furlow, M.D.*

ACUTE CONDITIONS SIMULATING ARTHRITIS ..... 463
*William K. Ishmael, M.D.*

STASIS ULCERS—A METHOD OF OPERATIVE THERAPY AND ITS EFFECTIVENESS .. 468
*Harvey R. Butcher, Jr., M.D.*

A COMPARATIVE STUDY OF SERUM CHOLESTEROL LEVELS IN THE EXECUTIVE AND WORKING GROUPS ..... 471
*Charles E. Thompson, M.D., F. J. Staack, M.D., Joseph C. King, M.D., and Logan Robertson, M.D.*

DIGITAL SKIN GRAFTING AS AN OFFICE PROCEDURE ..... 473
*Frederick Weiss, M.D.*

SILICONE PRODUCTS IN THE MANAGEMENT OF OCCUPATIONAL DERMATITIS ..... 474
*J. L. Salomon, M.D., L. Bausone, R.N., M. Scheunemann, and J. Ryan*

MENTAL HYGIENE IN INDUSTRY ..... 477
*W. H. Cruickshank, M.D.*

PRESIDENT'S PAGE ..... 482
*Jerome W. Shilling, M.D.*

LETTERS ..... 483

BOOKS ..... 484

EDITORIALS:

*The Iowa Breakfast Studies* ..... 485

*Multiple Cancerigenic Agents* ..... 486

ASSOCIATIONS AND PERSONAL NEWS ..... 4, 6, 8, 10, 12, 14

NEWS, COMMENT, OPINION ..... 49

ADVERTISERS' INDEX ..... 53



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# Hearing Loss in Relation to Industrial Noise-Exposure

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INFORMATION about the relations of modern industrial noise to employee hearing loss is difficult to obtain. This is due in part to the complexity of the relations at issue and in part to the difficulty of obtaining suitable research data. It is the purpose of this paper to discuss some of the major issues of the problem of noise-induced hearing loss, and to show some difficulties encountered in making inferences from existing industrial medical (audiometric) records.

In brief, the major issues are the amount of hearing loss that results from industrial noise exposure and the relative importance of different conditions in producing the loss. An evaluation of the amount of hearing loss requires a large number of audiograms representing many samples of persons, each sample having been subjected to a different noise exposure. This implies both initial and repeat audiograms made on the same employees under identical testing conditions and containing accurate information on amount and type of noise exposure. To be useful in assigning causal relations of hearing loss and noise factors, audiograms should be typical of the work groups studied. As for the variables that determine the amount of loss, one would predict different average losses for different types of exposure, i.e., over-all intensity and noise spectrum, impact versus steady state, etc.

An ideal research plan would require field experiments in which periodic audiograms are made at controlled intervals, with careful attention paid to the recording of noise level, time factors, and classification control data. Practical considerations limit the achievement of such ideal experimental conditions. For example, it has been shown that temporary threshold shifts of 10 or more db within one day of noise exposure are quite common. If hearing tests for research purposes were conducted at different times throughout the day, some of the measured thresholds would be contaminated with various and unknown amounts of this temporary threshold shift. Control of the variability produced by temporary threshold shifts would require that all ears under observation be measured at the same point in the work cycle. Such a control procedure is both expensive and impractical. It is this type of problem which has, thus far, limited systematic experimentation within industry.

There are at least two other procedures for studying the relations of hearing loss to noise-exposure. One is to conduct experiments within industry, substituting statistical controls for the more expensive manipulative controls. A second method is to study existing industrial audiometric records in an attempt to evaluate the important relations of hearing loss to noise-exposure. It is this last procedure which is illustrated and discussed below.



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## The Present Study

A LARGE aircraft manufacturer made available for research purposes a large sample of its audiometric records. The data from these records pertaining to hearing loss and noise exposure factors were entered on IBM cards and analyzed with reference to three major topics: (a) evidence for hearing loss caused by noise-exposure; (b) differences in hearing loss occurring in different occupations within the company, and (c) sources of error encountered in making audiometric comparisons from such records.

The data sample contained 9,145 audiograms of industrial and flight line personnel. These represented 5,816 different individuals: 3,212 factory workers and 2,604 flight line personnel. The remainder were repeat audiograms.

Supplementary information included age, history of exposure to noise, job category, and medical history. Age was indicated only by groups: 18-25 years, 26-35 years, 36-45 years, and 46 years or over. Exposure to factory noise was recorded in three classes: less than one year, one-to-five years, and five years or over. Flight line (jet) exposure time was specified in hours: 0-100 hours, 100-500 hours, 500 hours and over. Very few persons had experience in only one job category, the largest "pure" work group (1,196) being riveters. The medical history included information pertaining to the ear or any symptoms following exposure to noise.

The repeat audiograms included both periodic rechecks and special medical referrals, and it was unfortunately not possible to differentiate between these classes of records. Also, accurate serial records of exposure factors and information on changes in medical and work history were not always available.

## Hearing Loss Attributable to Noise-Exposure

THE RECORDS were first analyzed to determine whether they would show a relation between the length of time men had worked in noise and average hearing loss. For this analysis all factory workers were considered together, with no attempt to sort out particular job classifications. Since it was assumed that length of time in a noisy work environment is related to age, and since age itself is accompanied by a hearing loss, some method was needed to correct for age differences. Two different methods were used. One plotted years of noise exposure and hearing loss for decade age groups; the assumption being that within a decade the effects of age will be about the same for each noise-exposure group. The other method applied an age correction, determined from independent data, to the measured hearing losses.

1. *Curves Showing Hearing Loss versus Years of Noise-Exposure for Decade Age Groups. All Male Factory Workers:*

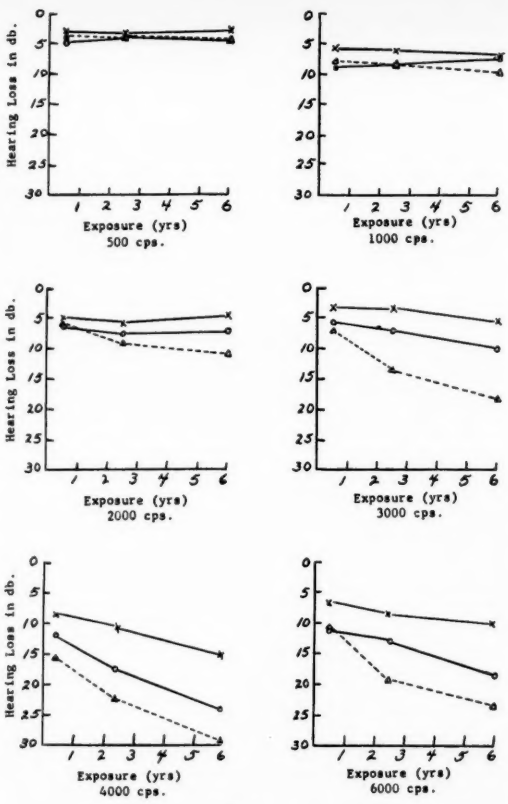


Fig. 1.
Median hearing losses for male factory workers with different lengths of noise-exposure. Right ear only:
Groups: x——x, 18-25 year ages, Ns = 710, 378, 67.
o——o, 26-35 year ages, Ns = 240, 330, 242.
△- - -△ 36-45 year ages Ns = 86, 187, 229.
Differences in losses are statistically significant at 4000 cps and 6000 cps for all age groups, and for 36-45 year group at 3000 cps. All other differences are statistically not significant.

Fig. 1 graphs the relation of hearing loss and years of noise-exposure for groups of male factory workers. Separate curves are presented for each of three age groups: 18-25 years, 26-35 years, and 36-45 years. At all age levels these curves show that losses at the higher frequencies are greater for longer exposure time. At frequencies of 2000 cps and below, there is less evidence of a systematic change with increases in exposure.

2. *Curves Showing Hearing Loss after Correction for Age versus Years of Noise-Exposure. All Male Factory Workers:*

For a comparison similar to that in Fig. 1 an age correction was applied to the hearing losses and a single curve plotted for each frequency (Fig. 2). The basis for this correction was the average hearing threshold obtained for 302 male office workers during the 1954 Wisconsin State Fair Hearing Survey.[1] These threshold values for each decade age group from the Survey were

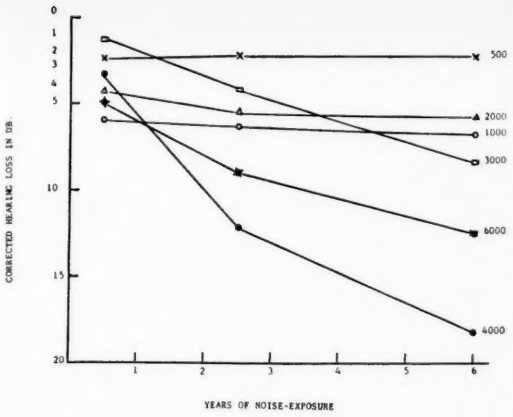


Fig. 2.
Median hearing loss for 2469 male factory workers with different lengths of exposure. Right ear only. A correction for age[2] has been applied.

taken to represent relatively "unexposed" ears, and were subtracted from the thresholds of the industrial sample to secure a "net" or "corrected" hearing loss. It will be noted that the curves in Fig. 2 show the same basic trends that were observed in Fig. 1.

3. *Curves Showing Hearing Loss versus Years of Noise-Exposure. Male Riveters Only:*

Both of the above figures confirm the expectation of an increase in hearing loss with increased duration of industrial noise-exposure. Since these results were obtained from factory workers as a group, it would be of additional interest to study separate occupational groups, i.e., workers who have had only one job (or type of noise-exposure). Unfortunately, only one job category, riveting, had a large enough number of men to yield meaningful trends. Their records were segregated from the previous group of all factory workers, and two sets of curves comparable to those already presented were plotted. They are shown in Figs. 3 and 4. Fig. 3 shows hearing loss versus exposure time for the decade age groups of riveters, and Fig. 4 shows hearing loss (with an age correction[2]) versus exposure time for all ages combined. Results for the riveters are basically the same as for the factory group as a whole.

4. *Statistical Test of Significance of Changes in Hearing due to Noise-Exposure.*

The general conclusion to be drawn from the results obtained so far (Figs. 1 to 4) is that increased durations of noise-exposure are accompanied by greater hearing losses — at least for the higher frequencies. Because it is possible that these changes in hearing might have arisen through a chance combination of factors unrelated to noise-exposure, a statistical test of significance (the chi-square test) was applied to one of the comparisons which was assumed to

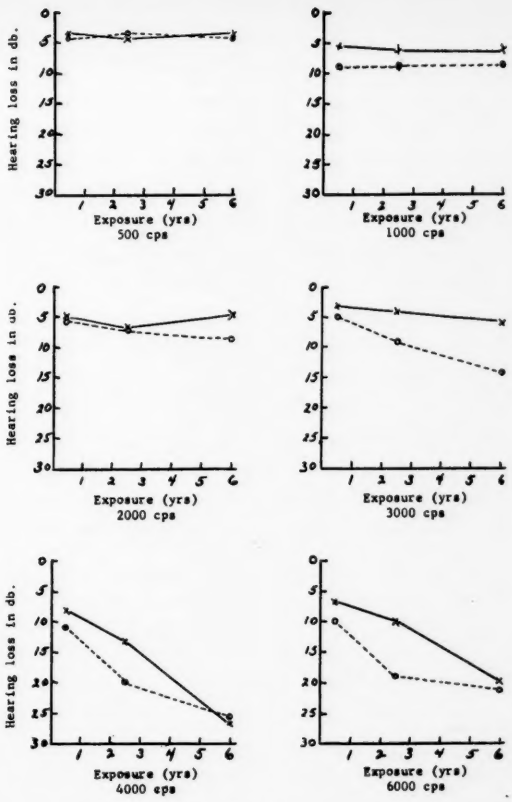


Fig. 3.
Median hearing loss for 1190 workers with riveting experience only, with different lengths of exposure. Right ear only:
Groups: X——X, 18-25 year ages, Ns = 604, 161, 20.
O - - - O, 26-35 year ages, Ns = 169, 143, 93.

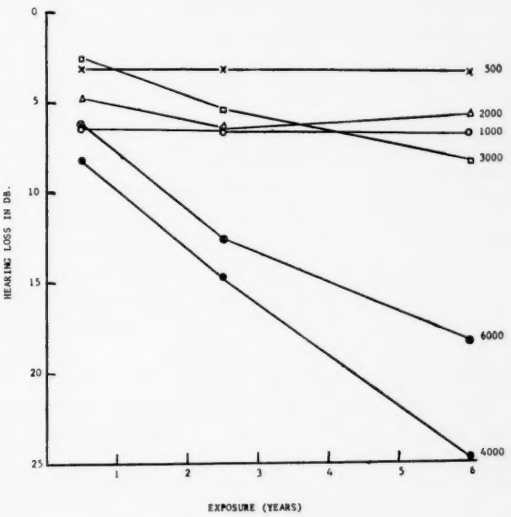


Fig. 4.
Adjusted median hearing loss for 1190 male workers with riveting experience only, with different lengths of exposure. Right ear only. A correction for age[2] has been applied.

be representative of all (Fig. 3). The test of significance is based on the assumption that if there were no differences in hearing loss among the members of the three exposure subgroups (less than one year, one-to-five years, more than five years), the median hearing losses for the subgroups would be equal to each other and to the median for the total (combined) group. Similarly, within each subgroup half the persons should have hearing losses greater than the median loss for the total group and half should have losses less than this median value. For each subgroup, the chi-square test was used to determine the statistical significance of the difference between the actual number of persons with hearing losses above and below the over-all median.

The results are very conclusive at 4000 cps and 6000 cps, indicating clearly that greater losses occur with longer exposures. (Chi-square values are 13.46 and 9.98 for 4000 cps and 6000 cps in the 18-25 year group, and corresponding values are 12.12 and 13.58 in the 26-35 year group. All are significant at the 1% level.) At 3000 cps, however, the difference is significant only for the older age group. All thresholds measured at frequencies below 3000 cps show insignificant differences by this criterion.

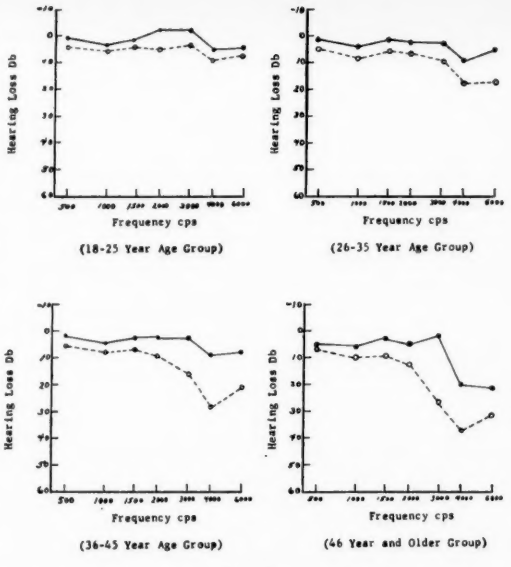


**Fig. 5.**
**Comparison of median hearing losses for men with riveting experience and with jet engine flight line exposure. Right ear only:**
**Groups: ●——● Jet engine flight line exposure**
**o - - - o Riveting.**

## Hearing Losses of Two Occupational Groups

AVERAGE threshold levels were compared for the riveters and for flight line mechanics exposed to jet noise. The plots of average hearing losses for men with riveting and men with jet flight line exposure histories were made separately for four age groups, and each showed a greater loss for riveters than for jet engine flight line mechanics. Although the differences in hearing loss for the two groups were large enough at some frequencies to appear to be significant, no attempt was made to evaluate their statistical significance.

The decision not to make statistical tests of the differences between riveters and flight line mechanics was prompted by comparisons of the curves in Fig. 5 with other sources of data. For example, the average audiograms for both groups, riveters and flight line mechanics, are higher (hearing better) at upper frequencies than average audiograms for any occupational group measured at the Wisconsin State Fair, including office workers. This fact suggests that a search be made for possible sources of bias in both sets of data. Particularly is it possible that some selective factors may operate in assigning men to a particular work category. Then, too, the sample of audiograms for a given plant Medical Department may be influenced by certain medical referral policies.

In general, if a group of industrial audiograms is to be adequate for estimating the average hearing loss for a particular occupation, or job group, certain statistical sampling requirements need to be met. First, the audiograms must be representative of the particular job group. They should reflect the composition of the group accurately with respect to all factors relevant to the crucial variable, hearing loss. One way to accomplish this is to have the sample exhaustive — to have it include everyone in the occupational class. Another way is to use a smaller number of members of the job class, selected purposively to represent the total group with respect to such variables as age and time on the job. The sample of audiograms should not include unknown proportions of new hires, medical referrals for hearing complaints, etc. The present sample does. Fortunately, this can be corrected in future samples by appropriate notation on the audiogram.*

In addition, it is necessary to determine what selective factors might be operating in the assignment of men or audiograms to a particular work category. Presume, for example, that the personnel department uses data from preplacement audiograms to screen prospective riveters and flight line mechanics. It may automatically reject persons who possess, on application, a hearing loss of 20 db or more. This fact alone would make a sample of riveters from that company possess hearing "superior" to the average of the company's employees.

Because the sources of bias operating in the

*It should be noted here that the sample being examined was collected before a standard form for collecting industrial hearing data was recommended (See 3).

selection of the group of riveters and flight line mechanics were not known, and because the representativeness of the sample could not be established, no attempt was made to evaluate the statistical significance of the differences in hearing between riveters and flight line mechanics shown in Fig. 5. But what are the implications of such possible sources of bias for the conclusions of other investigators drawn from similar data sources, as well as for the conclusions already drawn from Figs. 1, 2, 3, and 4? To answer this it is necessary to examine some principles of research design, particularly as they relate to sources of error in comparing audiometric measurements.

### The Nature of Error in Audiometric Comparisons

THROUGHOUT this report there are two classes of error which are being evaluated. These are, first, systematic or biasing errors which tend to make the values obtained from the samples differ in one direction (too large or too small) from the correct value; and second, variable errors (unreliability) which make measurements fluctuate from one occasion to another. The first class makes measurements "off" on the average, whereas the latter "hides" changes or relationships in a maze of variable, unstable numbers.

There are also two major sources of systematic error: (1) sampling biases, and (2) experimental biases. Differences in company policy for assigning men to various jobs may contribute sampling biases, i.e., errors introduced in choosing the sample of persons to observe. Experimental biases result from failure to control relevant factors while observations are being made. Examples include failing to control order effects (practice, fatigue, etc.) when making repeated measurements on the same persons, failing to equate comparison groups in such matters as age, or changing inadvertently the calibration of equipment between the time of testing one group and another. Any variables related to the threshold, if not controlled, may exaggerate changes in the threshold or may counteract the effect of the main factors under investigation.

The variable errors, or unreliability, can be attributed either to changes in procedure or equipment that occur erratically from time to time, or to unknown factors operating in the person being tested.

### Error Considerations in This Sample

THE FINAL section of this paper will examine sources of error in this sample more carefully, assessing their extent and evaluating means for overcoming them. First, some principles of sampling will be reviewed. Then the problem of statistical control of variables through the use of information from the audiometric record will be discussed. Finally, some sources of error variability (unreliability) will be evaluated.

SOME SAMPLING CONSIDERATIONS:

From the standpoint of sampling biases an important distinction is whether comparisons are made *within individuals* or *between individuals:* and, if comparisons are between individuals, whether they are made *within industry* groups or *between industries.*

If comparisons are made within individuals, sampling errors are likely to be minimal because the same individuals are observed under each of the conditions being compared. The use of the within-individuals design, however, is not full assurance that sampling bias is controlled, for the compositions of the group of individuals may influence the relation being studied in some way that is not readily apparent. Of even greater importance are subtle ways in which biases can creep into within-individual comparisons because the individual himself may change.

Individuals may get lower thresholds on repeat tests because they learned something on a prior test. Or, the first test may be a preplacement test and consequently free of temporary threshold effects, whereas repeat tests are taken during the work day after some noise-exposure. Fortunately, the extent of these errors can sometimes be estimated from other research results, and design considerations can be introduced to counterbalance their influence. When these factors are duly considered, the within-individuals design is one of the most promising for studying noise problems — such as the form of the function that describes the relation between hearing loss and duration of noise-exposure.

There are, however, many relations that cannot be studied within individuals, usually because the same person cannot represent two different exposure situations at the same time. (He cannot be both a "pure" riveter and a "pure" flight line mechanic.) Here comparisons must be made across groups and the cause of all differences among the groups must be determined. In this situation two major factors are at issue. As before, one involves systematic, or constant, error and the other involves variable error. The systematic errors include all between-group differences that are due to the consistent influence of factors other than those being studied. Variable errors may obscure or hide small changes. A sample selected from one company will usually show less variability than a sample which cuts across industries, because the single industry is more uniform with reference to a myriad of conditions such as noise level, testing technique, personnel policy, etc. On the other hand, a sample from one company may not be adequately representative of the over-all work group under consideration.

By careful sampling across industries it is



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possible to increase the likelihood that interpretations will be representative of industry in general, but this usually is accompanied by an increase in variability. No single answer, therefore, can be given to the question of whether it would be better to sample intensively within industry or between industries for the solution of problems such as are posed in this paper. Instead the initial step must be the careful specification of the populations and subpopulations about which conclusions are to be drawn. Only then can we evaluate questions concerning representativeness of smaller groups selected to represent these populations.

It becomes equally important to emphasize that the same attention must be spent on the careful specification of the variables being studied as is spent on the relations among these variables which are being hypothesized. When careful specifications are made it becomes possible to evaluate the representativeness of samples, to assess important relations between variables, and to control relevant variables in the sense of preventing them from confounding the relations at issue.

USE OF SUPPLEMENTARY INFORMATION OF THE RECORD:

If adequate information accompanies each audiogram the effects of many relevant variables can be controlled statistically. The essence of this procedure can be seen from Figs. 1, 2, 3 and 4 where two different methods were employed to control for age differences within the same exposure groups. In addition to age, at least four items of major importance should be recorded: noise-exposure specification, noise-exposure history, reason for making the audiogram, and time in daily exposure cycle at which the audiogram is made (this notation includes time of day, amount of previous exposure for that day, and time that has elapsed since the last exposure to noise on that day; i.e., 10 minutes, one hour, etc.). Other useful information includes medical and life history items that could conceivably influence the person's ability to hear.

*Age of worker:* Of paramount importance as a control factor is the age of the person tested. For maximum utility age should be specified in yearly intervals rather than in gross units. Ages in the present data were specified in gross groups only: 18-25 years, 26-35 years, 36-45 years, and 46 years and older.

*Type of noise-exposure:* An equally important specification is the recording of the kind and amount of noise-exposure. The present data employ fairly large, unequal time units for factory workers' exposure, namely, less than one year, one-to-five years, and five years or more; and smaller units, 0-100 hours, 100-500 hours, and 500 hours or more, for jet flight line personnel. Although different units may be desirable for describing the exposure properties of different noises, certainly some form of common exposure unit must be used if we are to compare hearing losses as a function of the noise-exposures of different jobs.

In addition to the time factors, accurate data on the noise environment are essential. The only description of noise available in the present audiometric records is that which can be inferred from the job classification or department of the worker. It is conceivable that such noise classification may be sufficient if we wish to evaluate hearing damage risk for certain families of jobs only. On the other hand, interindustry differences in the noise associated with given jobs or departments may require more detailed noise analysis. It is difficult to say, at this state of knowledge, what the optimum noise specification should be, e.g., whether octave band analyses are sufficient, or how impact noise, steady state noises, and various intermittent noises should be differentiated.

*Noise-exposure history:* For the long-term study, which is necessary in this field of investigation, there should be an accurate noise-exposure "history" for each man. Very few workers have had experience in a single work environment, and it is difficult or impossible to tell from present records what a man's past exposure to noise has been. (In addition to this information there should be a record, probably in the medical history, of any items that may be relevant to the development of a hearing loss from any known cause.)

*Reason for making the audiogram:* For research purposes it is desirable to have the employee's hearing tested at the time of employment and rechecked at standard intervals during his employ. Some audiograms, in addition to preemployment and recheck tests, will probably be made because of special medical referral. The purpose of the audiogram must be specified on the audiometric record so that special cases can be separated from routine rechecks and new hires. In the present sample this specification was not made.

It would help to speed the classification of the records if some standard method of identifying repeat audiograms were adopted.

*Time in daily exposure cycle at which audiogram is made:* Another important factor, about which information was not available in the present sample, is the point in the work (exposure) cycle at which the hearing measurement is made. Because noisy environments produce appreciable temporary or reversible threshold changes within the course of a single work day, it is not surprising that a worker whose hearing is measured after midday may have a threshold at some frequencies which is 10-20 db higher than if his hearing were measured before he began work.

The practical necessity of making clinical measurements throughout the work cycle will therefore contribute a significant amount of variable error. It is possible that corrections for such temporary threshold shifts can be applied statistically if two pieces of information are included in the record: time since the last noise-exposure, and the time in the work cycle at which the test is made — i.e., the amount of the day's exposure already experienced. Up to now this has not been recorded routinely by industry.

## Sources of Unreliability in Audiometric Records

IN AN attempt to evaluate the extent to which various sources of variable error exist in the present sample, a series of analyses were made of repeat audiograms. When the thresholds from the first two complete audiograms are compared for the 1,971 factory workers having more than one audiogram a fairly high degree of consistency is found. The average difference between measurements is less than 2 db at 1000 cps and less than 5 db at 4000 cps. These are the only frequencies for which this value was computed.

Coefficients of reliability were computed at two different frequencies by computing the coefficient of correlation between threshold values obtained from two successive audiograms of the same persons. The measurements had been made on different days, usually a few months apart. The coefficients of correlation obtained were .88 for 1000 cps, and .89 for 4000 cps. These values compare quite favorably with other published correlations between audiometric repeat tests.

The high reliability of threshold measurements is not an indication of the dependability of the supplementary control data accompanying the audiograms. Unfortunately, on some records workers may be placed in one age decade for a given audiogram and in an earlier (younger) decade for the next (later) audiogram. This type of discrepancy is sometimes present in the recording of other control factors, for example, amount of previous noise-exposure. In another sample of audiograms (similar to the sample examined here, but from a second industry) containing 159 repeat tests, each made within a period of a year or less from the date of the initial test, 40 of the noise-exposure specifications were found to be impossible or inconsistent. Among the inconsistent cases was one man who had two years' exposure at the time of his first audiogram and nine years' exposure at the time of his second test one year later, and a second man who had eight years' exposure at the time of his first test and only two years of exposure one year later.

To evaluate the unreliability in the control data of the present sample, the group of repeat audiograms was examined to determine the number (or percent) of persons who had less exposure on retest than on earlier measurements, or whose increase in exposure was logically inconsistent with the time between testings (e.g., recorded noise-exposure increasing two years in a six-months test-retest period). In the sample of repeat audiograms 3% had "impossible" recordings of exposure time (recorded exposure less on retest), and 1% had illogical data recorded. These figures suggest that more emphasis upon systematic, accurate recording of research control data is essential.

## Conclusions

1. DESIGN in industrial field research is largely restricted to appropriate tailoring of existing data-production methods. It is unlike laboratory research, where experiments can be designed to yield the types of data needed. And since manipulative controls are not feasible, statistical controls must be provided during analysis of the data — a fact which generally requires the collection of larger amounts of data.

2. Many restrictions are imposed on the use of audiometric data obtained through usual industrial channels because most industry groups are not homogeneous as to noise-exposure history, job continuity, use of ear protection, and time of hearing test during a day. Further, because companies differ in their methods of record keeping the data are likely to vary in respects that may limit the usefulness of the information in studies which combine company samples. Although such restrictions do not make the data useless, they do point out the need for careful scrutiny and skillful analysis if valid conclusions are to be drawn.

3. There are a large number of specific conditions which can reduce the validity of data collected in industrial situations. Some of these factors can be eliminated; for example, poor testing environments, poorly trained audiometric technicians, obvious errors in data recording, and nonstandard or inadequate method of data recording. On the other hand, there are many which can not be altered; for example, it is improbable that industry in general will be able to make all audiograms after a period of absence from noise-exposure.

4. In spite of restrictions and limitations, future industrial data can be used to good advantage if certain remediable faults are corrected.

5. Data will be more useful if the forms used to record the data are standardized. In a standard form particular attention should be paid to details of noise-exposure, to time of hearing tests, and to the reason for the hearing tests.

## Summary

A LARGE sample of audiograms was obtained from an aircraft manufacturer and analyzed,



XUM

both qualitatively and quantitatively. The main questions considered were: (1) is there evidence that hearing loss is caused by noise-exposure; (2) if so, is it possible to determine differences in the hearing losses occurring in different occupations; and (3) how valid are comparisons based on threshold measurements collected in this fashion?

Graphs of hearing loss versus length of noise-exposure are plotted for (a) all factory workers, and (b) the largest single job group, riveters. After the data are corrected for age, a significantly greater loss with longer exposure appears at frequencies above 2000 cps. Two different types of "correction" for age were introduced.

Average audiograms for two work groups, riveters and jet flight line mechanics, show differences of hearing loss as a function of job classification within this particular industry. When the absolute levels of loss in these work groups are compared to those from other sources of data some inconsistencies appear. For example, both the riveters and the flight line mechanics in the industrial sample showed less hearing loss than the office workers in the Wisconsin State Hearing Survey sample.

Possible explanations for the discrepancies disclosed are bias operating in the selection of the sample and nonrepresentativeness of the audiograms. For research purposes industrial records should contain accurate data on at least: age in years of the person tested, standardized specification of the noise environment, an accurate record of the man's exposure history, a statement of the reason for making the audiogram, and the date and time within the work cycle that the measurement was made.

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## Dividends

AMONG thoughtful persons concerned with the health of large groups of people, there is an increasing realization that health is purchasable. Not necessarily the health of any specific individual, but relative health among large groups of people can be provided by the sound thinking of medical scientists and by the dollars of taxpayers and industries. As an example: typhoid fever is no longer a significant threat to the health of society. This health dividend was purchased by the clear-thinking medical scientists who developed typhoid vaccine and by taxpayers who paid for a reliable water supply. Dental health, in a relative sense, is also purchasable. The same is true of industrial health. Recently a gynecologic examining service was conducted in the Medical Department of the plant at Pisgah Forest, and examinations were provided for 316 women employees. These examinations were carried out by gynecologists from neighboring communities at a cost of approximately $1,000. Of the 316 women examined, 185 were rated as having no significant abnormalities. The remaining 131 were referred to their personal physicians for diagnostic or therapeutic follow-up. The diagnosis of carcinoma in situ was made and confirmed in three cases. This is the earliest recognizable form of cancer of the uterine cervix. The dividends to these three women in terms of both survival and economy are not measurable, but certainly the cost of the examining service is inconsequential as compared to the benefits. In a sense, health *is* purchasable.

—From "Occupational Health Pays Dividends," by MAC ROY GASQUE, M.D., Industrial Medical Department, Olin Mathieson Chemical Corporation, in *North Carolina Med. J.*, April, 1957.



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# Management of Acute Head Injuries

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THE NUMBER of patients who sustain head injuries is so great that the problem is one for the entire medical profession rather than for the neurosurgeon. The American Board of Neurological Surgery has certified 694 physicians, but 120 persons are injured every hour in the United States by automobiles alone! Because of the tremendous number of accidents, it is essential that the general practitioner or the industrial surgeon have the necessary basic knowledge to insure the intelligent handling of such a patient; and I must admit, with some shame, that neurosurgeons have at times confused rather than clarified the issues involved. Arguments about details, such as the use of spinal punctures, or a regime of "dehydration" have become so involved that the basic principles in management have been lost in controversy. It is in the hope of clarifying some of these principles that I speak to you today.

It is my belief that a rational plan of management should be divided into two parts: (1) initial evaluation, and (2) definitive treatment.

IN THE initial evaluation, the first step is to determine the state of consciousness of the patient. The first duty to the profoundly unconscious patient is to be sure that there is an open airway, for cerebral anoxemia may do great damage in a relatively short time. This is best accomplished by placing the patient on his side with the head lowered, and if the obstructing material, which may be mucous, vomitus, blood or spinal fluid, is too tenacious to run out, suction should be used immediately. If it is impossible to establish and maintain an open airway by such means, emergency tracheotomy should be resorted to without hesitation, for many patients may be saved by such a procedure. Once an adequate airway is established oxygen should be administered in some appropriate manner, for even though cyanosis may not be obvious on observation, there may be sufficient anoxemia to cause nerve cell damage.

If the patient is not deeply unconscious, the cough reflex will be preserved, and the above-mentioned measures may not be necessary, but in all patients the next step should be to determine whether traumatic shock exists. If so, the shock should be adequately treated, disregarding, for the moment, the head injury except for those measures which may be necessary for the control of hemorrhage from scalp vessels.

This hemorrhage may be controlled by pressure dressings or by application of Michel clips to the lacerated scalp edges, and once this has been accomplished, the shock, if present, should be vigorously treated by the administration of blood, plasma, etc., and the consideration of other problems should be deferred until the shock is brought under control.

As a final phase in the initial evaluation, one should determine whether there are injuries to other parts of the body. This survey should include an examination of the chest, abdomen, extremities, and a careful search for evidence of injury to the spine or spinal cord. Damage to the spine may easily be overlooked in the irrational or unconscious patient.

UPON completion of the initial evaluation, one must proceed toward definitive treatment. The most important necessary decision is a determination as to whether actual surgery may be necessary. If it is decided that surgery may be indicated, the patient should be placed in a hospital equipped to handle neurosurgical conditions. This means not only the availability of a neurosurgeon, but the easy accessibility of suction, electrocoagulation, and all of the instruments that may be necessary. It may be stated as a general rule that the best interests of the patient will be served by transporting him to the neurosurgeon, rather than by having a neurosurgeon come to him; for even if the necessary armamentarium be present, the postoperative care should be directly supervised by the operating surgeon.

In some instances, the need for surgery may be obvious, for the discharge of blood and pulped brain tissue from a scalp laceration indicates a compound depressed fracture with torn dura and penetration of the brain. There can be no argu-

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XUM

ment but that such a patient will need radical debridement of his wound as soon as his general condition is satisfactory, so he should be sent to a suitable hospital as soon as shock is relieved and active superficial hemorrhage controlled. In other instances, however, the need for surgery may be determined only after repeated neurological evaluation and continued observations of vital signs. As a general rule, it may be stated that any one of the following signs, or any combination of these signs, should be considered as an indication that surgery may be necessary, and the patient should be sent into a hospital with neurosurgical facilities:

1. Deepening coma in a patient not in shock.
2. Progressive focal neurological signs.
3. Dilated pupil.
4. Cerebrospinal rhinorrhea.
5. A fracture line which on x-ray is seen to cross the groove for the middle meningeal artery.
6. A depressed fracture, simple or compound.
7. The presence of air within the cranial cavity.
8. A shift of the calcified pineal from its usual midline position.

I do not consider it advisable at this time to undertake a description of the various operative procedures which may be necessary in the treatment of acute head injuries. Rather do I feel that it is important to try to outline to you in an understandable manner those things which would make you realize that surgery may be essential.

IT IS UNFORTUNATE, I believe, that in a discussion of this sort, too much emphasis has been laid upon the recognition of extradural hemorrhage from the middle meningeal artery. It is true that almost all such patients not surgically treated will succumb. In another sense, however, it is possible that this subject may have been overemphasized, for actually this is a relatively rare lesion, and it is a mistake to say that surgery is unnecessary once such a lesion has been ruled out. It is true that deepening coma, progressive focal neurological signs, dilated pupil, and evidence of decerebrate rigidity may be seen with an extradural clot but the same picture may be found with an intradural or intracerebral clot. For that reason, the surgeon who opens the skull must be capable of doing whatever may be necessary within the skull, for a surgical procedure originally planned for extradural hemorrhage may develop into one used for the removal of an intracerebral clot. This merely serves to emphasize the fact that this type of surgery should not be undertaken by persons who are not versed in its principles, and it should only be done in an institution which is equipped with all of the necessary mechanical aids for the accomplishment of its purpose.

For a number of years, neurosurgeons have come to use more and more exploratory burr openings in the treatment of acute head injuries. These openings are accompanied by a minimum of risk and are almost always carried out under local anesthesia. Naturally, neurologic signs, if present, serve as an indication for the localization of such openings, but in some cases focal signs may be lacking. The patient who is becoming progressively more comatose and who is not in shock may not have a dilated pupil, a focal convulsion, or a progressive hemiparesis, so in many cases these openings may have to be made on both sides. One should not hesitate, if necessary, to add ventriculography to the diagnostic procedure even in the acute phase, because I firmly believe that these diagnostic procedures when properly used may produce an appreciable lowering of the mortality rate.

Cerebrospinal rhinorrhea is a complication of the acute head injury which may have serious consequences. Avenues of infection from the nose and accessory sinuses are opened up, and, while there is no question that the use of antibiotics has greatly reduced the risks, if the leakage persists for longer than 10 to 12 days, surgical correction is indicated.

The necessity for surgery should always be considered in the patient who has a depressed fracture of the skull. If the lesion be compounded, there can be no argument, for radical debridement should be carried out as soon as the patient's general condition will permit. After the scalp, bone, dura, and macerated brain have been debrided and all bleeding controlled, the dura should be closed or repaired by fascial graft, for this will aid in combating infection and minimize the subsequent cerebral cicatrix. If the risk of infection is not great, suitable bone fragments may be replaced so as to prevent a skull defect, but I do not believe that cranioplasty with tantalum or a plastic should be done as a primary procedure if reasonable doubt exists as to the sterility of the wound.

As to the necessity for surgery in the simple depressed fracture, there may be some argument. However, I believe that in these cases the bone should be elevated if the depression is sufficient to cause cerebral compression, and more particularly if this compression be in the mid-portion of the cerebral hemisphere. The incidence of posttraumatic convulsions is increased as the lesion occurs nearer to the motor cortex and in my opinion this complication may be prevented in some instances if the bone be elevated to its normal position.

The demonstration by radiography of intracranial air is always reason for consideration of surgery. Spontaneous pneumocephalus may be considered as a reverse cerebrospinal rhinorrhea, and the opening through which the air enters should be closed before intracranial infection supervenes.



XUM

The displacement of a calcified pineal from its mid-line position on a properly posed radiograph is always evidence of a space-occupying intracranial lesion which must be accepted until disproved. The lesion may be clot or subdural fluid resulting from the trauma, or tumor or abscess which is entirely unrelated, but in any instance the opinion of a neurosurgeon should be sought.

FROM THE foregoing, one could imply that definitive surgery might be the rule in the treatment of the patient with an acute head injury. This is an implication which should be avoided, for by various estimates it may be stated that surgery will be indicated in approximately 20 to 30% of such patients. This would indicate that the majority will require only intelligent medical and nursing care, and the responsibility of the attending physician is twofold: (1) to be certain that the need for surgery is not overlooked, and (2) to be certain that measures are employed which will reduce mortality and morbidity. The first requires repeated and continued observations of the patient as to the general state and neurologic signs. The second requires evaluation of certain controversial issues.

Perhaps the greatest point of controversy has been over the necessity or advisability of spinal puncture. In neurosurgical literature, opinions may be found which are so radically different as to say, on the one hand, that spinal puncture should never be done, while on the other extreme, it may be advocated every three to four hours for the purpose of reducing intracranial pressure! Personally, I feel that both extreme opinions are wrong, for while spinal puncture should never become a routine procedure, it may be useful from both a diagnostic and a therapeutic standpoint. Diagnostically, it may be advantageously used in the patient who is brought in unconscious but in whom history is lacking. Such a patient may have evidence of trauma to his head, but it may be difficult to determine whether the trauma be incidental or causative insofar as the disturbance of consciousness is concerned. In the absence of signs of a sustained state of increased intracranial pressure, such as papilledema, a carefully done spinal puncture with a measurement of pressure and examination of the fluid for blood or other abnormal cells may be invaluable. As a therapeutic measure, spinal puncture may be profitably used to relieve the headache, photophobia, and stiff neck due to meningeal irritation from hemolyzing blood which may come on several days after the initial trauma. Here again, however, the puncture should be carefully done under manometric control, and in no case should jugular compression be done. The Queckenstedt test is of no value in intracranial injuries and it may be dangerous, for the increase in venous pressure could cause renewed bleeding or brain stem compression by herniation.

Another measure about which there has been considerable controversy is the use of various substances for purposes of "dehydration." It is my belief that the controversy is wholly unjustified, for the regime is valueless. Fluid and electrolyte and protein needs are the same in the patient with acute head trauma as in any other patient, and the needs should be so handled. If unconsciousness persists longer than one to two days, it is advisable to institute feedings by indwelling nasal tube so that total nutritional requirements may be met. I can see no value in concentrated glucose, sorbital, sucrose, etc., as a part of the management of the acute head injury.

Any patient who has cerebrospinal rhinorrhea or otorrhea, or fracture into the sinuses, should be given antibiotic coverage as a means of reducing the incidence of infection. In these patients, I try particularly to avoid spinal puncture for the reversal of flow of fluid may be the means of introducing virulent organisms and so precipitate meningitis. Bladder function should be watched, for a full bladder may induce violent restlessness, and a wet bed will cause pressure sores. Indwelling catheter, with or without tidal drainage, should be used without hesitation, but appropriate drugs to minimize urinary tract infection are indicated.

Some patients with acute head trauma may be very noisy and restless. It is important to avoid drugs which produce respiratory depression, so morphine should not be used. Chloral hydrate, paraldehyde, or the barbiturates may serve a useful purpose, but in many instances the restlessness may be due to a full bladder, bright light, noise, etc., so good nursing care is invaluable.

Radiographic study is important in the evaluation of the acute head injury, but rarely is such a study an emergency procedure. It should not be undertaken if the patient is in shock, or if the necessary movement incidental to the examination might do harm. The minimum study should consist of a lateral of either side and anteroposterior and posteroanterior views of the skull. Films which are technically bad because of position, exposure factors, or developing may be worse than no films at all, so they should be made only when proper personnel and equipment are available. It is particularly essential in industrial cases that the films be accurately interpreted, for the reporting of a simple vascular marking as a linear fracture may lead to innumerable medicolegal problems.

Bed rest has a place in the management of acute head injuries, but it should *not* be overemphasized. Early ambulation is important, and bed rest extending into weeks should be avoided. Personally, I advocate getting the patient out of bed when he is conscious, rational, and has no



XUM

complicating injury elsewhere to prevent his being up. I am convinced that many serious posttraumatic neuroses have been produced by overemphasis on possible sequelae by the family or the attending physician. In any case, it is important that the patient not be given the impression that his injury is more serious than may be apparent to him from his symptoms, and this is a vital point in the industrial case. Such overemphasis may lay the groundwork for long periods of idleness and precipitate many legal difficulties.

Finally, one must not overlook the possibility of a subdural hematoma in the patient who makes a rapid and satisfactory recovery from what appears to be a simple, uncomplicated head injury. The development of headache, vomiting, diplopia, convulsions, choked discs, or other neurologic signs in such a patient makes thorough diagnostic study imperative, for this is a lesion which if treated properly before severe cerebral compression occurs has little mortality or morbidity. The simple evacuation of the lesion through a burr opening with removal of the high protein fluid by irrigation is usually all that is necessary. It should again be emphasized, however, that surgical treatment should not be undertaken without some objective evidence to suggest such a lesion, for posttraumatic headache is common in industrial or medicolegal cases.

In conclusion, may I say that it soon becomes obvious to any physician who treats a large number of patients with head injuries that there will always be a mortality rate. The injury to the brain is, in some instances, incompatible with life. The aim of the profession must be to keep this mortality rate at a minimum, and I believe that attention to the principles enumerated will save a certain number of patients who may appear, when first examined, to be fatally injured.

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## "Partial Absenteeism"

HOW ACCIDENT-PRONE are alcoholic employees? Popular belief that alcoholic employees tend to have more accidents than workers who don't drink excessively is refuted in recent study by Harrison M. Trice, Assistant Professor, New York State School of Industrial and Labor Relations. He interviewed and studied work histories of 163 problem drinkers — of whom 98 were exposed to work accidents. Key findings: an overwhelming majority (between 75-80%) of subjects studied reported they had never had a work accident. Only 22 out of the 98 subjects said that their accident rate had increased after they became problem drinkers. Here are reasons why alcoholic employees tend to have fewer work accidents than is generally believed: most importantly, problem drinkers become more cautious than regular employees, try to conceal fact that they drink excessively by taking pains not to call attention to themselves by having accident. Because problem drinker is aware of times when he is most apt to have accident, he frequently becomes absent during these periods. Says Professor Trice: "The problem drinker begins to engage in a unique form of absenteeism, 'partial absenteeism.' He comes to the job but, if possible, leaves before the day is over. He realizes he cannot get through the day without a drink. This compulsive urge to drink is so overpowering that he leaves the job. So he again removes himself from exposure to accident at just the time when his proneness is unusually high. This peculiar form of absenteeism tends to occur near the end of the middle stage of alcoholism." Fellow employees, in covering up for the problem drinker, generally try to protect him from accidents — for example, by performing more hazardous part of alcoholic's work. Repetitive nature of many jobs held by problem drinkers also tends to protect them from accidents. By contrast, workers whose jobs lack routine, who are required to move about a community (especially in an automobile!) are more likely to have accidents. —From *Industrial Relations News*, August 24, 1957.



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# Acute Conditions Simulating Arthritis

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OVER 100 different conditions are capable of producing pain in the musculoskeletal system. However, most pain of this nature occurs simply as the result of a structure's being subjected to more wear and tear than it has the strength to withstand. This may be illustrated by the sore arm of a baseball pitcher, or a blister in the hand following overuse of a shovel. Three factors contribute to a condition of this sort. They are the physical trauma present; the toughness or strength of the structure making it capable of withstanding stress; and the psychological make-up of the individual which causes him to persist in his endeavors after he has "had enough." These three factors, or any combination of the three, are capable of producing distinctive patterns of pain, or types of "acute conditions simulating arthritis," dependent upon the proportionate degree of influence of each. An organic disorder is capable of altering the functional or structural capacity of a part thereby rendering it susceptible to stress, or it may, through its destructive process, be it disease or injury, in itself be the entire cause of pain. Trauma and wear and tear, if sufficiently violent or severe, are well-known causes of painful stress reactions in normal structures. On the other hand, a perfectly normal structure performing ordinary tasks will eventually become painful if the endeavor is unremittingly continued.

The relative influence of each of these three factors must be determined in all patients before definitive countermeasures may be undertaken. This can be done with a high degree of accuracy by careful evaluation of the history and physical findings as outlined in Table I.

Probably the most significant feature in differentiating the cause of musculoskeletal pain is the time of day when the patient has the most discomfort. If the cause of the pain is organic in nature, particularly of rheumatic origin, the most discomfort occurs upon awakening in the morning after a night's rest. These individuals characteristically are stiff and sore but feel better as they "limber up," and many of them feel their best at bedtime. Postural or mechanical strain, on the other hand, produces increased pain as the subject fatigues proportionately to his daily endeavor. Frequently the patients will mention the approximate time of day the pain will begin. They are relieved by rest periods, and they do not have the tendency to "gel" following periods of immobilization. The pain resulting from conversion hysteria, psychogenic rheumatism, or in patients who are malingering is usually expressed as "I'm never any better."

One is also guided in his decision as to the cause of pain by the anatomical distribution of the discomfort. If the complaints occur in predictable areas, one suspects organic disease or postural or mechanical strain. Contrariwise, the person with psychogenic rheumatism "hurts everywhere." Response to treatment is a helpful guide. The patient with organic disease is relieved, at least to a degree, by analgesics, whereas the patient with postural strain or psychic disturbance has slight, if any, results from such measures. Whereas many opinions exist as to the weather, or climate, effect on musculoskeletal disorders there is good evidence to show that a person with an organic lesion of the bone or supporting structures is affected by climatic change. This would not be true in the patient with mechanical strain or psychogenic disorder.

Possibly the easiest mistake to make in evaluating a musculoskeletal complaint is to treat a patient for an organic lesion visible on the radiogram when the disease is not the cause of the complaint. It is very important that the complaints and physical findings be in predictable areas. This would be true in organic diseases and in most instances in postural or mechanical strains. The patient with psychogenic rheumatism, or the malingerer, frequently has the "touch-me-not" reaction.[1]

Careful inquiry into all of these factors in each patient with a stress reaction is highly rewarding in evaluating his pain, and hence a more effective management results.

## Differentiation of Organic Pain

AFTER determining proportionate importance of an organic defect in the cause of an "acute condition" one must then differentiate the type of organic lesion present. Any condition resulting in fatigability of the musculoskeletal system would contribute to a painful stress reaction. However, direct causes of organic pain may be:

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XUM

1. TRAUMATIC OR MICROTRAUMATIC CAUSE:

Pain follows immediately in predictable areas. Discomfort is worse on motion and relieved by rest. Muscle spasm and pain are relieved by traction, and there is predictable relief from the use of analgesics. A lapse of time usually improves the patient's condition if there are no complications. Lacerations, contusions, swelling or abrasions may be present, with localized soreness and tenderness. If there is an internal derangement of the joint there is likely to be associated locking of motion.

2. RHEUMATIC OR COLLAGEN DISORDER:

Discomfort occurs following a variable lapse of time following the trauma. Discomfort gets worse on motion, but there is less relief from rest as compared to traumatic cause of pain. There is a tendency to "gel" following rest or inactivity. Pain and muscle spasm are improved by compression and the use of antiphlogistic and analgesic drugs. A lapse of time may intensify the symptoms or result in exacerbations and remissions.

3. TUMORS OR EXPANDING LESIONS:

Pain is unremitting and is inclined to "hurt around the clock." The night pain is consistent to one area and is somewhat relieved by the patient's moving about. There is predictable relief from the use of narcotic caliber drugs. A lapse of time consistently worsens the pain and systemic manifestations.

INFECTIONS:

A localized abscess produces the same signs and symptoms as tumor (expanding lesion) except that it is subject to more rapid change or remission. There may be systemic signs of chills, fever, malaise, and a dramatic response to proper antimicrobial agents.

5. NEUROVASCULAR OR REFLEX SYMPATHETIC DYSTROPHY:

Pain is erratic both in type and area involved, characterized by burning, stinging, numbness, or a "scalded feeling," varying from one to another. Color and temperature changes are variable — white, red, or blue. The part may be hot, cold, dry or wet, with edema of the entire part. There is a tendency for the discomfort to involve the entire extremity, with likelihood of fibrosis associated with contracture and atrophy of the portion of the extremity involved. A lapse of time produces unpredictable effects on the pain. There is, however, a strong tendency for the condition to run a "course." Reflex sympathetic dystrophy does not respond well to analgesics, or antirheumatic or antiphlogistic agents.

NEURITIS OR NEURALGIA:

The pain occurs in predictable dermatomes and is characterized by numbness, sharp "shooting," "stabbing," or burning pain. There may be weakness or paralysis or atrophy selective to the dermatome involved. This condition may follow injury, infections (diphtheria, meningococcus, poliomyelitis virus, encephalitis virus), metal poisoning, or noxious agents, collagen disease, malignancies, C.V.A., diabetes mellitus, porphyrinuria, multiple sclerosis, combined lateral sclerosis, pernicious anemia, or vitamin B deficiencies.

TABLE I.
A GUIDE TO THE DIFFERENTIATION OF ORGANIC, FROM POSTURAL, OR FROM PSYCHOMOTOR, OR MALINGERING FACTORS IN THE CAUSE OF MUSCULOSKELETAL COMPLAINTS

| | Organic Disease | Postural or Mechanical Strain | Psychomotor or Malingering |
|---|---|---|---|
| Stiffness and soreness upon arising in A.M. | Marked and significant | No, unless patient has lain in a position producing strain. Feels best after night's rest | "Worse all the time," or "never get better" |
| Complaints in predictable areas | Yes | Yes | No. "Hurt everywhere" |
| Relieved, at least to a degree, by analgesics | Yes | Very slight, if any | "Nothing helps" |
| Affected by weather | Yes | No | No; at least not consistently |
| Does pain awaken patient at night? | Yes, especially if an expanding lesion in bone (tumor, abscess). No, if pathology mild | Not unless postural strain occurs. Relieved by changing positions | No. May have insomnia from other causes |
| Degree of pain proportionate to objective findings | Yes | No | No |
| Physical findings in predictable areas | Yes | Yes | No. "Touch-me-not" reaction |
| Evidence or signs of organic disease | Apt to be present | Yes, if anatomical defect is cause of strain. No, otherwise | No |
| Radiographic change | Usually present | Only if anatomical defect is cause | No. If changes are present, of no significance |
| Laboratory change | Yes, if characteristic of disease | No, unless part of factor causing fatigability | None pertinent to disease |



XUM

## Anatomical Syndromes Simulating Arthritis

REGARDLESS of the cause of a stress reaction there are many similarities in the resulting symptomatology, depending upon the anatomical area involved. The most frequently encountered symptomatology complex in our Clinic is the cervical tension syndrome, recently popularized as the "whiplash neck." This syndrome may be characterized by a painful, tender, achy, or "cricky" neck. Or there may be headaches, "neuralgic pains" in the occipital, facial or temporal areas of the head. Sometimes there is dizziness, vertigo, faintness, a sense of imbalance; or "crazy feelings" in the head may occur. Many patients complain of pain radiating into the scapular or shoulder areas, or under the arms or upper anterior chest. A "frozen shoulder," or shoulder-hand syndrome sometimes occurs in patients beyond 40 years of age who have cervical lesions. In our experience neck pathology is the most common cause of shoulder-arm pain. The next most frequently encountered syndrome occurs as a result of changes in the lower lumbar spine. These patients characteristically have pain, stiffness and soreness in the lower lumbar spine, which at times, may result in acute and severe muscle spasm which they term "lumbago." Characteristically, this pain may radiate into the sacroiliac areas and frequently into the posterior hip areas. Occasionally the pain may radiate around the crest of the ilium or into the posterior thigh, and if there is specific nerve root irritation there are pain and paresthesia in the area of the involved dermatome of the sciatic nerve. Less frequently, coccygodynia and pain radiating into the rectal and perineal areas may result from these low back syndromes. Another disturbing symptom complex known as meralgia paresthetica may result when the lateral femoral cutaneous nerve is involved in the low back reaction.

Frequently overlooked is the thoracolumbar syndrome which causes pain to radiate from the thoracolumbar area of the spine in a girdle-like fashion into the lower chest and upper abdomen, many times in a manner indistinguishable from upper intra-abdominal pathology.

Bursitis may be a severely painful condition, but possibly does not occur as often as it is diagnosed. This is particularly true of the painful shoulder. The enserine bursa of the knee, when inflamed, produces a characteristic syndrome of rather intense burning pain along the lateral margins of the knee, aggravated by full extension, with palpable tenderness in the area of the bursa. Calcaneal bursitis affects the posterior portion of the heel and should not be mistaken for the more distressing "painful heel" syndrome which involves the plantar surface of the heel. The trochanteric and ischial bursae are probably inflamed more frequently than they are diagnosed, and are more prone to occur in individuals whose occupations require them to sit for long hours in a saddle or in the seat of a machine, such as a bulldozer or tractor. The bursae of the bunion joint, or the MTP joints of the little toe, are frequently involved in individuals with hallux valgus deformity of the foot. Improved shoe design has materially reduced foot complaints over the past 10 years.

Tenosynovitis is not an infrequent cause of pain and disability and undoubtedly results in more shoulder pain than does bursitis. An involvement of the extensor policis longus, where it traverses the wrist, may be so severe as to require surgical intervention. The long head of the biceps tendon frequently becomes inflamed at the point where it traverses the bicipital groove of the humerus and is known in the sports world as a "glass arm." Inflammation of the lateral epicondyle of the humerus, usually referred to as the "tennis elbow," is a very troublesome syndrome which may be mistaken for intra-articular pathology. Since the advent of injectable Hydrocortisone compounds used along with local anesthetizing agents, the management of these troublesome syndromes such as bursitis, tenosynovitis, and epicondylitis has been greatly simplified.

Dupuytren's contractures, also known as "throttle hand," usually are symptomless but occasionally will result in pain and soreness in the palm of the hand, extending into the flexor portion of the fingers. Occasionally this process may be sufficiently severe to cause contraction and disability in the fingers. This disorder frequently accompanies the shoulder-hand syndrome, Volkman's contractures, as well as local trauma to the palm of the hand.

The painful heel syndrome suggests low back pathology as the result of either degenerative or rheumatoid arthritis. The removal of the spurs in this condition is usually therapeutically disappointing.

The abduction, or "arm over the head," syndrome is at times indistinguishable from the reflex sympathetic dystrophy resulting from cervical radiculitis, postcoronary infarction, or other causes of pain in the upper extremity. Numbness, tingling, burning, and stinging associated with some swelling and possibly color change are usually present. This patient rarely admits sleeping with his arms over his head, however, and many times the arm must be fastened to his side during the night to prevent perpetuation of this syndrome.

The temporomandibular syndrome is not an infrequent cause of sharp and severe pain in the face and head, and is quite easily mistaken for tic douloureaux or earache. The diagnosis is suspected when the pain is aggravated following meals, and, if the patient has an obvious defect in articulation of his teeth, audible or palpable



XUM

crepitation may be present in the affected joints. Dental consultation is necessary to correct this syndrome.

Malum coxa senilis is probably one of the most distressing of all the articular disorders and may follow congenital defects, growth disturbances, trauma, or disease states of the hips. This syndrome frequently leads to severe disability, and whereas surgery leaves a great deal to be desired some of the newer acetabular prostheses have offered sufficient function to allow a reasonable amount of activity.

### Physiological Disturbances

PHYSIOLOGICAL disturbances capable of rendering the musculoskeletal system susceptible to stress are syndromes that may result from many causes. As previously mentioned, however, there is usually a factor of trauma, plus the psychomotor tendency to keep going in spite of fatigue, but as a rule there is also some basic underlying phenomenon which causes the structure to give way under stress more easily than it normally would or previously had. Primary osteoarthritis, or the familial type of degenerative arthritis, is probably one of the more frequently encountered causes contributing to a stress reaction. Osteoporosis, of the low steroid or deficiency type, or that occurring from disuse, is also frequently seen as an offender. Personality traits which tend to produce conversion hysteria, or hypochondriasis, should be considered in the category of causative agents in stress reactions. Malnutrition is a well known cause of fatigability. The collagen diseases are usually suspected in any painful syndrome occurring in the musculoskeletal system.

Osteomalacia, diabetes mellitus, focal infections, thrombophlebitis, and tumors must be ruled out in each instance, and occasionally one meets the patient with gout who has the intense, severe local reaction which may follow one to five days after trauma. The correction, so far as possible, of these disorders capable of contributing to a stress reaction is an integral part of the treatment.

### Management

THE MAJORITY of patients with a simple stress reaction heal spontaneously without need of interference from a physician. However, should the symptomatology continue beyond the two-to-three-week normal healing period one must then search for the perpetuating factors responsible for the chronicity exhibited. The patient encountered with this type of disorder is usually one who basically is inclined to become keyed up instead of sleepy when he is overly tired. This, in turn, leads to restlessness and insomnia, producing more fatigue leading to greater tension. The pain which naturally results from this type of strain leads to further lack of rest and tension, producing more pain. Disability, loss of work, and fear of becoming crippled only aggravates this entire situation. As a result, this patient may get worse instead of better, and a chronic, or progressive, state may be produced.

Measures employed by the physician which serve to break up the vicious circle established and which correct the basic defects initiating the disorder usually result in satisfactory recovery for the patient.

1. CORRECTION OF THE MECHANICAL FORCE:

Protection from lordotic positions of the lumbar spine along with the use of traction with hips and knees flexed in severe cases.[2] Paul Williams[3] type of flexion exercises are indispensable in these low back cases.

Cervical Tension Syndrome: The patient must be protected from forward thrust positions of the head and neck. The contour pillow, as described by Ruth Jackson,[4] frequently controls distressing symptoms radiating from the cervical spine. Cervical traction is frequently helpful, particularly where radicular pains refer into the upper extremities.

Orthopedic consultation is indicated in many situations. Braces or surgery are needed occasionally in ruptured intervertebral disks, spondylolisthesis, or severe instability of the vertebrae.

Physical therapy: To reduce muscle spasm and promote motion and function is needed in many cases.

Measures should be employed to aid in rehabilitation and in education of patients who have been severely disabled or whose symptoms are prone to continue.

2. CORRECTION OF METABOLIC ERRORS, NUTRITIONAL DEFICIENCIES, OR DISEASE-PRODUCING FATIGABILITY OF THE STRUCTURES INVOLVED:

Osteoporosis may require the use of sex steroids, supplemental proteins or vitamins as indicated.

Osteomalacia if present responds to calcium and vitamin D. If the renal type of osteomalacia is present, calcium and vitamin D plus an alkaline buffer is necessary.

Atrophy of disuse may be avoided by early ambulation of the patient and by the use of specific exercises. Physical therapy is advisable in the more severely involved patients.

The postgastrectomy syndrome, pernicious anemia, and certain senility changes respond gratifyingly well to the use of vitamin B-12.

All coexisting diseases should be corrected when possible.

3. CORRECTION OF PSYCHOMOTOR FORCES:

(a) Protection of the overly conscientious and compulsive patient from going beyond his endurance.

(b) Avoidance of sleep loss.

(c) Utilization of rest. In many instances it

is necessary for the patient to improve his ability to enjoy himself.

(d) Correction of known disorders capable of producing "nervousness," such as hyperthyroidism, pellagra or lesser B complex deficiency, hypocalcemia, the climacterium, premenstrual tension states, etc.

(e) Use of tranquilizing and analgesic drugs to break up "vicious circle" of pain and sleep loss, producing tension. Utilization of daytime naps.

(f) Psychiatric consultation is usually needed in patients who have true psychogenic rheumatism or conversion hysteria or severe degrees of anxiety, depression, or melancholic states.

(g) Recognition of the malingerer.

## Conclusion

THE MOST frequently encountered cause of musculoskeletal pain is the result of a structure's being driven beyond its endurance. Correction of the amenable factors contributing to this stress reaction usually results in satisfactory remission of symptoms.

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# Their Greatest Asset

HUMAN MAINTENANCE Pays Off. That is the title and the point of a recent speech by Dr. E. E. Luongo, Medical Director, General Petroleum Corporation. It deals with the widespread and growing realization that " . . . the greatest asset of a company is its people." American industrial management is deeply concerned with industrial health and safety programs. In Dr. Luongo's view, "No more intimate aspect of good human relations exists in business today." He writes of the experience of his own company — typical in general of a great number of companies, in industries of all kinds. First, there is heavy emphasis on preventive medicines. Periodic examinations are offered to all, at intervals determined by age, knowledge of physical defects, and occupation. These are conducted either by physicians of the company's Medical Department or by private physicians designated by the Department. The examinations and questioning may go beyond the purely physical and into the broad realms of psychology. No attempt is made to evaluate these examinations with any line of demarcation between executives and nonexecutives. In his view, "Unfortunately there is a growing tendency today to overemphasize the health problems of executives. In our experience we have found that executives are no more prone to ulcers, coronary disease, or various neuroses involving 'dependent behavior' than are the nonexecutives in the same age group." The results of the health program conducted by this company are impressive. The incidence of disabling and fatal cardiovascular heart disease has been decreased by 15% since 1948. There have been no disabling consequences among the diabetics since 1950. The incidence of overweight has been reduced from 25% of employee population in 1951 to 15% in 1956. Mortality from cancer of internal organs in males has dropped 33% since 1948, and disabling mortality from cancer in females has decreased 50%. Substantial progress has been made in the complex field of mental health. For example, there has been a reduction in explosive human relations problems attributable to emotional upsets, and in industrial accidents traceable to emotional origin. The benefits of such work to employee and employer are obvious. In addition, tangible benefits accrue to the community at large. As Dr. Luongo puts it, "When a maximum number of workers is reporting to the job, and working at an optimum level of efficiency, the butcher, the baker, and the banker are benefited." In many cases, the health programs are responsible for keeping families from becoming public charges. Finally, Dr. Luongo makes another highly important point — that such work as this need not and should not be confined to large business: "These programs should become more widespread in industry so that advanced stages of preventable to curable diseases will be rare occurrences in our clinics and hospitals. These programs are as important to small businesses as they are to larger ones. Small businesses can less afford to lose key personnel due to illness."

—From an Editorial in *Olympia Washington Olympian*, July 30, 1957.



XUM

# Stasis Ulcers

## A METHOD OF OPERATIVE THERAPY AND ITS EFFECTIVENESS

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MANY variations of the treatment of stasis ulcers support the old observation that the greater the number of treatments recommended for a disease the less the likelihood that any of them possesses great worth. Since early times[1] the therapy of stasis ulcers has been based upon four tenets: bandage support, obliteration of varices, the application of chemicals, and covering of the ulcer with metals and membranes. Relatively minor changes in therapy have been made in the past 50 years.

The purpose of this study is the further evaluation of the method of therapy used since 1951 in the Barnes Hospital, St. Louis, for stasis ulcers which have failed to heal or repeatedly recurred despite the use of elastic support and the control of varices. Only patients with uncontrolled stasis ulcers operated upon by the resident staff of the Barnes Hospital are included.

### Method of Treatment

INDIVIDUALS with stasis ulcers not controlled by bed rest at home, elastic support, cleanliness, and the excision of varices were hospitalized and managed preoperatively as follows:

Arterial flow deficiency as a cause of ulcer was ruled out. The palpation of pulses, oscillometry, and occasionally arteriography were used.

The extent of atrophic skin, and dermal and subcutaneous fibrosis about the ulcer was determined by palpation and in many instances by the injection of superficial lymphatics.[2] All superficial varicosities were carefully outlined.

Bed rest with elevation of the ulcerated extremity for five to 10 days often was necessary to control edema. Frequent (every two to four hours) moist saline dressings were applied to the ulcer after cultures of it were taken. Preoperative control of infection in and about the ulcer is requisite for a successful graft take. Penicillin or other indicated antibiotics were used in patients with associated cellulitis. The subsidence of all active inflammation before operation is mandatory.

Sterile preparation of the leg and foot for 24 to 48 hours before operation was performed to avoid infection in the postoperative period.

The operation consisted of the excision and stripping of all superficial varicosities of the extremity after high ligation and division of the saphena magna and its tributaries at the sapheno femoral junction, the excision of the ulcer and its base down to normal tissue and all the inelastic thickened skin and fascia about it; and the immediate coverage of the cutaneous-fascial defect with thick partial thickness cutaneous autografts. All atrophic skin in which the superficial cutaneous lymphatics could not be injected was excised.

The experience from continued observations of patients having this type of operative therapy for stasis ulcer has indicated the important points of operative technique and postoperative care to be:

The use of absorbable sutures for hemostasis (triple-0 chromacized catgut).

The avoidance of excision of periosteum or peritendineum.

Immobilization of the leg and foot with a firm bulky dressing for six to eight days.

Postoperative care of these patients should include keeping the feet and legs upon the bed for 14 to 21 days, and the wearing indefinitely of elastic supports while sitting or standing.

### Results

TABLE I summarizes the results of the operative therapy for stasis ulcers used in the Barnes Hospital since 1951.

Fifty-nine persons had stasis ulcers which could not be kept healed by conservative measures. The extremities of these individuals were operated upon and treated according to the above regimen 13 to 52 months ago. Forty-nine (83%) are free of ulcer. However, six of these have had secondary operations for recurrent ulceration and subsequently have remained healed 12 months or more. Only one of the seven patients with recurrent ulceration subjected to reoperation still has an ulcer. This person had an extensive circumferential ulcer which required excision of most of the skin of the lower leg and dorsum of

Presented at the Sixty-Ninth Annual Meeting of the AMERICAN ASSOCIATION OF RAILWAY SURGEONS, Chicago, April 9-11, 1957.

Fig. 1.
These three photographs show the extent of excision that may be required to remove adequately the fibrotic skin and subcutaneous tissues about and beneath stasis ulcers. This patient had bilateral large nearly circumferential stasis ulcers of many years' duration. The photographs were made three weeks postoperatively.

the foot. Eighteen months after initial operative therapy recurrent ulceration followed trauma from a stirrup.[1] Despite three subsequent attempts at further excisions and grafting, ulceration persists.

## Summary

THE treatment of the stasis ulcer remains time-consuming and difficult. Failure of healing to be permanent still is common.

This study shows that the radical operative removal of diseased veins, atrophic skin, and fibrotic subcutaneous and fascial tissues about and beneath the ulcer and the securance of immediate coverage with partial thickness cutaneous autografts is followed by permanent healing in 80% of individuals suffering with stasis ulcers.

The extent of cutaneous excision often required adequately to treat extensive stasis ulceration is indicated. Complete removal of all atrophic skin and fibrotic subcutaneous and fascial tissue beneath and about the ulcer is required. The pertinent points remaining which need be observed to attain the best result are:

TABLE I.
THE RESULTS OF OPERATIVE THERAPY FOR THE CHRONIC STASIS ULCER (1951-1955)

| | Months After Operation | | | | |
|---|---|---|---|---|---|
| | 49-52 | 37-48 | 25-36 | 13-24 | 13-52 |
| Number of Patients | 15 | 25 | 12 | 7 | 59 |
| A. Patients Without Ulcer | 14 | 19 | 10 | 6 | 49 (82%) |
| (1) Required reoperation since healed 12 or more months. | 2 | 3 | 1 | | 6 |
| (2) Patients dead of other causes (healed 17-35 mo.) | 2 | 2 | 1 | | 5 |
| (3) Patients healed when lost to follow-up 21-26 mo. after operation. | | 4 | 2 | | 6 |
| B. Patients With Persistent Ulcer | 1 | 6 | 2 | 1 | 10 (17%) |
| (1) Number having reoperation still with ulcer | 0 | 1 | 0 | | 1 |
| (2) Number lost to follow-up with ulcer (after 38 months) | 1 | | | | 1 |

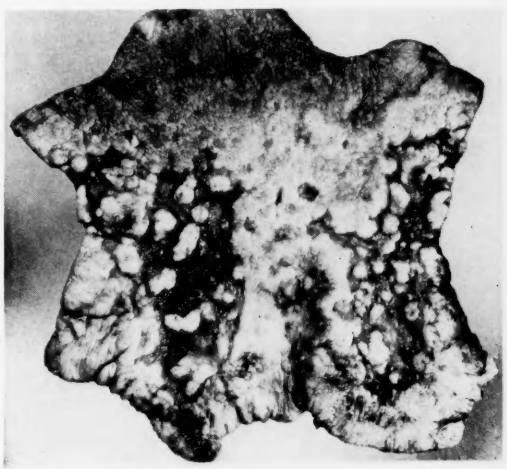

Fig. 2.
The surgical specimen removed from the right leg of the patient in Fig. 1, shows the extent of ulceration persisting at the time of operation. The bridge of fibrotic thickened skin shown near the middle of the photograph persisted over the achilles tendon. The lower portion of the specimen was removed from the malleolar areas.



XUM

The control of infection and edema preoperatively by bed rest, elevation, frequently changed moist saline dressings, and occasionally antibiotic therapy systemically. Careful preoperative sterile preparation of the skin of the leg for 24 hours should be done.

The use of absorbable suture material for hemostasis. This avoids the persistent sinus and the granulomatous ulcer.

Careful attention to details of application and dressing of the autografted area is required to insure complete graft take. Incomplete take of graft or its partial loss is associated with more postoperative edema, and a higher incidence of recurrent ulceration. Excision of periosteum and peritendineum needs be avoided.

The patient should be kept in bed for 14 to 21 days postoperatively. Earlier dependency is regularly attended by the lifting of the grafts from their beds in part or in toto, by confluent petechial hemorrhages.

Elastic supports should be worn by the patient continuously while sitting or standing. The combined well-being of the leg and especially the graft requires that all patients maintain meticulous cleanliness of the extremity.

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# Big Business

INDUSTRIAL MEDICAL ASSOCIATION lately undertook a survey of expenditures in Industrial Medical Departments throughout the nation during the year 1956. Questionnaires to 3200 members were sent out; as of this writing the replies slightly exceed 14%. Following are some interesting — though incomplete — figures, thus far available from the survey: As to initial cost of basic equipment for Medical Department and/or Plant Hospital or Clinic, 367 companies state their expenditures were $19,532,040.71. OTHER COSTS: *Vision testing equipment*, 304 companies expended $264,119.67. *Hearing testing equipment*, 207 companies expended $300,211.42. *X-ray equipment*, 281 companies expended $6,407,763.91. *Physical therapy equipment*, 340 companies expended $1,102,073.38. *Laboratory equipment*, 225 companies expended $715,709.51. *Oxygen and resuscitation equipment*, 286 companies expended $305,843.22. *X-ray films*, 267 companies expended $670,935.93. During 1956 — for *current medical and surgical products and supplies*, 352 companies spent $921,769.79; and for *drugs and pharmaceuticals*, 237 companies expended $1,917,903.81. Interestingly, 70% report that they prescribe some drugs and pharmaceuticals; 58% that they recommend some drugs and pharmaceuticals; and 79% that they supervise and/or recommend the purchase and use of equipment.

*A Comparative Study of*

# Serum Cholesterol Levels in the Executive and Working Groups

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DURING the compilation of data for an earlier statistical study of 600 executives, recently published by two of us, it was noted that elevation of total blood cholesterol, where suspected, was frequently found, although the test was not then routine.[1] Because of the increasing importance of hypercholesterolemia in studies concerned with vascular disorders,[2,3] it was decided to make a survey of two population groups with particular reference to total blood cholesterol.

The larger group is concerned with 1104 white men who represent the population of one plant with no attempt made to separate economic levels. Five-hundred white men of the executive level of various companies are used in the other group. Although race, ethnic origins and dietary habits introduce variabilities, it is felt that these studies would be significant.

Cholesterol determinations were done by the Pearson-Stern-McGovack technique in Group I. In the executive group, or Group II, determinations were done by the Bloor method.

TABLE I.
FREQUENCY DISTRIBUTION TABLE
Cholesterol Values for the White Male Population (1104)
Champion Paper and Fibre Company, Pasadena, Texas

| | Total | | Age | | | | | |
|---|---|---|---|---|---|---|---|---|
| Cholesterol | N | ≷N | ≷20 | 21-30 | 31-40 | 41-50 | 51-60 | ≷61 |
| 150 - 159 | 5 | 5 | | 3 | 1 | | 1 | |
| 160 - 169 | 4 | 9 | 1 | 2 | | 1 | | |
| 170 - 179 | 16 | 25 | 1 | 11 | 2 | 2 | | |
| 180 - 189 | 24 | 49 | 3 | 18 | 2 | 1 | | |
| 190 - 199 | 54 | 103 | 2 | 30 | 13 | 9 | | |
| 200 - 209 | 96 | 199 | 4 | 50 | 33 | 5 | 4 | |
| 210 - 219 | 61 | 260 | 1 | 32 | 19 | 9 | | |
| 220 - 229 | 160 | 420 | 1 | 68 | 55 | 31 | 2 | 3 |
| 230 - 239 | 77 | 497 | 2 | 23 | 29 | 21 | 2 | |
| 240 - 249 | 68 | 565 | | 23 | 27 | 13 | 5 | |
| 250 - 259 | 97 | 662 | | 33 | 37 | 22 | 4 | 1 |
| 260 - 269 | 147 | 809 | | 50 | 62 | 25 | 10 | |
| 270 - 279 | 61 | 870 | | 11 | 36 | 11 | 2 | 1 |
| 280 - 289 | 92 | 962 | | 25 | 37 | 24 | 5 | 1 |
| 290 - 299 | | | | | | | | |
| 300 - 309 | 40 | 1002 | | 7 | 14 | 15 | 3 | 1 |
| 310 - 319 | 33 | 1035 | | 11 | 9 | 10 | 3 | |
| 320 - 329 | 14 | 1049 | | 2 | 4 | 7 | 1 | |
| 330 - 339 | 13 | 1062 | | 1 | 6 | 5 | 1 | |
| 340 - 349 | | | | | | | | |
| 350 - 359 | 11 | 1073 | | 3 | 5 | 2 | | 1 |
| 360 - 369 | 10 | 1083 | | 1 | 2 | 6 | 1 | |
| 370 - 379 | 6 | 1089 | | 1 | | 3 | 2 | |
| 380 - 389 | 4 | 1093 | | 1 | 2 | 1 | | |
| 390 - 399 | 3 | 1096 | | | 3 | | | |
| 400 - 409 | 4 | 1100 | | 1 | | 2 | 1 | |
| 410 - 419 | | | | | | | | |
| 420 - 429 | 2 | 1102 | | | 1 | 1 | | |
| 430 - 439 | | | | | | | | |
| 440 - 449 | 1 | 1103 | | | | | 1 | |
| 450 - 459 | | | | | | | | |
| 460 - 469 | | | | | | | | |
| 470 - 479 | 1 | 1104 | | | 1 | | | |
| TOTAL | 1104 | | 15 | 407 | 400 | 226 | 48 | 8 |
| No. with Cholesterol > 250 mgm% | | | 0 | 147 | 219 | 134 | 34 | 5—Total - 539 |
| Percent of Population | | | 0% | 36.1% | 54.8% | 59.3% | 70.8% | 62.5%—Total - 48.8% |

TABLE II.
FREQUENCY DISTRIBUTION TABLE

| | Total | Age | | | | | |
|---|---|---|---|---|---|---|---|
| Cholesterol | | ≷20 | 21-30 | 31-40 | 41-50 | 51-60 | ≷61 |
| 136 - 149 | 2 | 1 | | | | | 1 |
| 150 - 159 | 2 | 1 | 1 | | | | |
| 160 - 169 | 3 | | 1 | 2 | | | |
| 170 - 179 | 7 | | 1 | 4 | | 2 | |
| 180 - 189 | 5 | | 1 | 3 | | 1 | |
| 190 - 199 | 8 | | | 4 | 4 | | |
| 200 - 209 | 12 | | 2 | 4 | 5 | 1 | |
| 210 - 219 | 21 | | 1 | 11 | 6 | 3 | |
| 220 - 229 | 16 | 1 | 2 | 5 | 4 | 2 | 2 |
| 230 - 239 | 30 | | 1 | 13 | 13 | 1 | 2 |
| 240 - 249 | 26 | 1 | 1 | 9 | 11 | 3 | 1 |
| 250 - 259 | 29 | | 3 | 12 | 10 | 2 | 2 |
| 260 - 269 | 26 | | 5 | 4 | 12 | 3 | 2 |
| 270 - 279 | 39 | | 3 | 8 | 17 | 9 | 2 |
| 280 - 289 | 36 | | 2 | 11 | 18 | 4 | 1 |
| 290 - 299 | 41 | | 1 | 11 | 16 | 13 | |
| 300 - 309 | 30 | | 2 | 5 | 15 | 7 | 1 |
| 310 - 319 | 33 | | | 9 | 11 | 10 | 3 |
| 320 - 329 | 29 | | 1 | 6 | 12 | 9 | 1 |
| 330 - 339 | 25 | | | 5 | 11 | 6 | 3 |
| 340 - 349 | 23 | | 2 | 3 | 9 | 9 | |
| 350 - 359 | 16 | | | 5 | 5 | 6 | |
| 360 - 369 | 9 | | | 4 | 5 | | |
| 370 - 379 | 8 | | | | 4 | 4 | |
| 380 - 389 | 6 | | | 2 | 1 | 2 | 1 |
| 390 - 399 | 6 | | | | 5 | 1 | |
| 400 - 409 | 3 | | | | 1 | 2 | |
| 410 - 419 | 1 | | | | | 1 | |
| 420 - 429 | 4 | | | | 3 | 1 | |
| 430 - 439 | 3 | | | 1 | 1 | 1 | |
| 440 - 449 | 1 | | | | 1 | | |
| TOTAL | 500 | 4 | 30 | 141 | 200 | 103 | 22 |
| No. with Cholesterol > 300 mgm% | 0 | 5 | 40 | 84 | 60 | 8—Total - 197 | |
| Percent of Population C Cholesterol > 300 mgm% | 0% | 16.6% | 28.5% | 42.0% | 59.1% | 36.4%—Total - 39.4% | |



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Since there are varying opinions as to the upper limit of the so-called "normal," which is significant in atherogenesis, it was decided to use 250 mgm% as the dividing line in the Group I. This figure was used since 539/1104, or 48.8%, of the total group had cholesterol >250%. A somewhat higher figure is selected for the executive group.[4] Although 238/500, or 47.6%, of this segment had cholesterol over 290 mgm%, it was decided that 300 mgm% would be less subject to argument due to greater chance of laboratory error and/or variable factors in the method used in this group. If one uses the commonly given upper limit of normal (Bloor Method) in studying the executive group, the figures are altered as shown in Table II A.

Although we feel that the figures in Table II A may be unrealistically high, some authors[5] feel that with recent evidence of a greatly increased incidence of atherosclerosis lower values are significant.

A significant difference, in addition to the percentage differences, is immediately apparent in the groups expressed in the above tables, namely, the executive group is largely older than the group listed in Table I. More subtly, the economic differences are undoubtedly of importance as the executive, with mild to modestly severe chronic disease would be more prone to retire (and thus not be included in the study) while the factory worker would probably continue to work in a similar situation. Unquestionably, there are also major dietary differences in the two groups, i.e., the executive group is from the midwest while the factory group is from southern Texas. Beyond this, no reasons are apparent in the two groups to account for the observed differences in cholesterol levels.

The executive group expressed in Table II has been further studied in relation to weight, blood sugar, and protein bound iodine. Protein bound iodine determinations are used because of the greater accuracy in determining thyroid function. Insofar as possible, all instances of elevated PBI due to iodine medication have been eliminated.

TABLE II A.

| | ≤20 | 21-30 | 31-40 | 41-50 | 51-60 | ≥61 |
|---|---|---|---|---|---|---|
| No. with Cholesterol > 250 mgm% | 0 | 19 | 86 | 157 | 90 | 16 |
| | | | | Total — 368 | | |
| Percent of Population $\overline{C}$ Cholesterol > 250 mgm% | 0% | 63.3% | 60.9% | 78.5% | 87.3% | 72.7% |
| | | | | Total — 73.6% | | |

TABLE III.

| | | |
|---|---|---|
| Total overweight (in excess of 10%) | 134 | 26.8% |
| Total high cholesterol $\overline{C}$ overweight | 54 | 10.8% |
| Total underweight | 5 | 1.0% |
| Total high cholesterol $\overline{C}$ underweight | 2 | 0.4% |

Weights have been calibrated using tables prepared by the Metropolitan Statistical Bureau and from Cecil and Loeb.

TABLE IV.

| | | |
|---|---|---|
| Total PBI > 6.0 mcgms. | 88 | 17.6% |
| Total PBI 4.0 - 4.5 mcgms. | 68 | 13.6% |
| Total PBI 3.5 - 4.0 mcgms. | 85 | 17.0% |
| Total PBI less than 3.5 mcgms. | 46 | 9.2% |
| High Cholesterol $\overline{C}$ PBI > 6.0 mcgms. | 33 | 6.6% |
| High Cholesterol $\overline{C}$ PBI 3.5 - 4.0 mcgms. | 32 | 6.4% |
| High Cholesterol $\overline{C}$ PBI < 3.5 mcgms. | 19 | 3.8% |

TABLE V.

| | | |
|---|---|---|
| PBI > 6.0 mcgm assoc. $\overline{C}$ overweight | 31 | 6.2% |
| PBI < 3.5 mcgm assoc. $\overline{C}$ overweight | 15 | 3.0% |
| PBI > 6.0 mcgm overweight & elevated cholesterol | 12 | 2.4% |
| PBI < 3.5 mcgm overweight & elevated cholesterol | 6 | 1.2% |

TABLE VI.

| | | |
|---|---|---|
| FBS > 120 mgm% (308) cases | 18 | 5.84% |
| FBS > 120 mgm% assoc. high cholesterol (308) | 10 | 3.25% |

Unfortunately only 308 of the 500 cases are available for study of blood sugar and cholesterol.

## Summary

A STUDY of blood cholesterol levels in 1104 white men factory workers from Texas and 500 serially-examined white male business executives from the midwest is presented. Elevation of blood cholesterol above laboratory normal is significant in a high percentage. This is not explained by coexisting disease generally considered to produce elevation of cholesterol level. The results indicate that more attention should be paid to this determination in periodic examinations since increasing importance is being assigned to this substance in more and more studies of atherosclerosis and vascular disease. This study suggests that elevations of cholesterol increase after the third decade. We are continuing these studies in the hope that more information can be gained from a larger series considering the relationship, if any, to the atherosclerotic process.

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# Digital Skin Grafting as an Office Procedure

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WE WISH to present a technique of immediate skin grafting, done on partial amputations of distal phalanges, as an office procedure. Our cases have proved this to be a practical, expedient approach to the handling of certain problems that are sometimes encountered in industrial and private practice.

The aim in these amputations has been to preserve the digit, thereby retaining, as much as possible, a normal-looking distal phalanx with nail growth and functional efficiency.

It should be unnecessary to subject patients to unwarranted 'waiting' anxiety such as is often entailed in hospital arrangements. We have felt that many times tissue is further sacrificed by doing a disarticulation to effect a satisfactory flap. We realize that in many quarters skin grafting as an office procedure has been decried; and we recognize that many techniques have been described that are time-consuming, expensive, and require, at times, multiple operations.

The major causes of these trauma problems are punch press, car and refrigerator door avulsions, gear injuries, and accidents with electric saws.

The cases are usually seen within half an hour from time of injury. Immediate x-rays determine bone continuity and involvement. A rapid appraisal is made of the apparent vascularity, especially in compression injuries involving more than the avulsed portion.

The detailed step-by-step technique employed is as follows:

The hand is thoroughly cleansed with hexachlorophene detergent.

Ring block — usually effective with 2 to 3 cc of xylocaine at the base of the digit. No tourniquet is used.

Debridement of stump, removal of small bony fragments, and trimming down of bone, if it should project beyond soft tissues.

The surface is so prepared that the soft tissue presents a fairly flat surface.

In the interim, the inner aspect of the upper arm is prepared, with thorough cleansing, and blocking of the area with local anesthesia. A split-thickness graft of the required size is removed, using a sterilized razor blade.

There is immediate transference of the graft to the recipient site, teasing the graft into place, and smoothing it over to cover all raw areas. No sutures are necessary.

Telfa is applied over the graft with numerous dressings for well-padded compression. The digit is then bandaged, and a protective aluminum splint is placed over the entire dressing.

The donor site is covered with vaseline gauze, multiple thicknesses of sterile gauze for pressure, and elastic bandage for outer dressing.

Postoperative care consists of the following:

Dress the donor site in five days, with subsequent redressings as indicated.

The digit with the graft is not redressed for 10 days.

Tetanus immunization and penicillin are administered as indicated by the specific circumstance surrounding the trauma. Only three of our cases required penicillin administration.

The course of these cases reveals complete healing within two weeks. The patient is permitted to return to work, preferably in a job not utilizing the involved hand. Occasionally it is necessary to administer analgesic agents.

Our technique has given the maximal gratifying results in 38 cases of such trauma as above described. All of our cases have had 100% healing, per priman, without failure.

## Summary

A PRACTICAL procedure is described, which is accomplished, as part of office routine, in about 30 minutes from beginning to end, with preservation of a maximal amount of the digit; a cosmetically and functionally-efficient distal phalanx; and a minimal healing period. The time of disability is diminished, with its resulting compensation payments; and the total cost to the company or insurance carrier is diminished by virtue of no hospital costs. There are minimal postoperative sequelae — such as tender scars, dimpling from scarring, paresthesias, and prolonged healing time.



XUM

# Silicone Products in the Management of Occupational Dermatitis

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IN 1956 AN employee, working on the "Magnaflux" operation in the Receiving-Inspection Department, presented a suggestion to the Suggestion Program Committee that a recently-marketed silicone product* be provided for the employees. When this was forwarded to the Medical and Safety Sections for comment, it was considered advisable to incorporate this and other products into a then current study, and thus investigate several phases of the various problems of protectants in industrial dermatitis before expressing an opinion.

It is generally agreed by almost everyone connected with industrial medicine that dermatitis has long been the greatest composite of all occupational diseases. Though other occupational diseases have gradually been controlled, dermatitis has repeatedly resisted control. It has continued in spite of the many and varied approaches that have been tried by numerous investigators. Few will deny that many basic or associated factors, such as increased capillary permeability, allergy, anemia, psychosomatic factors, focal infections, seasonal changes, and others, may predispose to a dermatitis in many cases. With any of these present, there is a greater chance for the employee to present a dermatitis case. The ever increasing use of solvents, detergents, and unsaturated hydrocarbons in the numerous and varied aspects of modern production methods is constantly enlarging this problem. Investigators have shown that many of these substances cause the loss of the sulfhydrl groups and thus alter the keratin structure of the cells so as to decrease the normal protective barrier of the skin. Many of the industrial washing powders contain abrasives and have been considered by some as often causing minute abrasions which could become the portal of entry for these substances to initiate a dermatitis.

The effectiveness of various silicones has been known for several years, and the literature on their application to various aspects of medicine is increasing. However, there have been few reports of studies made concerning their medical application in industry.

Several years ago a group headed by the late N. A. Klucikowski, M.D., then Medical Director of our Division, developed a protective ointment which contained two silicone products. At first, the combination seemed to meet the general requirements, but later it had to be altered. It was found that rust spots developing on precision parts were probably due to the water content of the lanolin base. When anhydrous lanolin was substituted in the formula, this problem was corrected. It was replaced, however, by another problem: the composition was thick and hard to apply, so that the employee acceptance was unfavorable. The suggestion made by the employee, as mentioned, thus came at a timely moment, presenting an excellent opportunity for expanding the then current study into a broader comparative study.

## The Study

IN THE "Magnaflux" operation, metallic parts are magnetized and then bathed with a solution of kerosene in which iron oxide powder is suspended. At any break or fault in the part, the magnetic field attracts the iron oxide particles and thereby sharply outlines the defect which thus is easily noted by the inspectors. After inspection the parts are demagnetized, washed, dried, and packed for transfer to machining or other operations.

Investigation showed that the supervisor of this "Magnaflux" operation was already rotating the employees through the various stations. Each employee was in the area of greatest exposure for a maximum of two hours at any one time, and this occurred at most only three times a week. All the employees were females, of wide range as to age and variety of complexion types. For several reasons, such as smallness of parts, type of solvent, etc., rubber, plastic or other types of gloves could not be used in this operation.

In preparing for our study the product suggested by the employee, together with the silicone

*Lotion containing: Dimethyloplysiloxane, glyoxyl diureide, champhor, menthol, hexachlorophene, and alcohol; marketed under the name "SILICARE" by Pharmacal Division, Revlon, Inc., New York City.

| NO. | CASE | PRETEST CHECK 4-12 | CHECK NO. 1 4-13 | CHECK NO. 2 4-16 | CHECK NO. 3 4-18 | CHECK NO. 4 4-20 | CHECK NO. 5 4-23 | CHECK NO. 6 4-25 | CHECK NO. 7 4-27 | CHECK NO. 8 4-30 | CHECK NO. 9 5-2 | CHECK NO. 10 5-4 | CHECK NO. 11 5-7 | CHECK NO. 12 5-9 | CHECK NO. 13 5-11 | CHECK NO. 14 5-18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AW+N-44 | $R_1T_2$ | $R_1T_3$ | $R_2T_3$ | $R_3T_4$ | $R_2T_4$ | $R_3T_3$ | $R_1T_2$ | $R_1T_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |
| 2 | VB+N-01 | $R_2T_2$ | $R_1T_2$ | $R_1T_2$ | $R_2T_3$ | $R_4T_4$ | $R_3T_3$ | $R_1T_1$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |
| 3 | AK+N-23 | $R_3T_3$ | $R_1T_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_2T_2$ | $R_3T_4$ | $R_3T_4$ | $R_3T_4$ | $R_4T_4$ | $R_2T_1$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |
| 4 | LZ+N-61 | $R_3T_3$ | $R_1T_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ | $R_2T_2$ | $R_2T_2$ | $R_3T_3$ | $R_2T_3$ | $R_4T_4$ | $R_1T_1$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |
| 5 | PK+N-24 | $R_1T_1$ | $R_2T_2$ | $R_1T_1$ | $R_3T_4$ | $R_4T_4$ | $R_3T_3$ | $R_2T_3$ | $R_4T_4$ | $R_4T_4$ | STOPPED UNDER $R_1$ | $R_3T_3$ (OFF-JOB) | $R_1T_1$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |
| 6 | IH+N-34 | $R_1T_1$ | $R_1T_2$ | $R_1T_2$ | $R_1T_1$ | $R_1T_1$ | $R_1T_N$ | $R_2T_1$ | $R_2T_2$ | $R_3T_4$ | $R_3T_4$ | $R_4T_4$ | $R_1T_1$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |
| 7 | GK+N-31 | $R_1T_1$ | $R_2T_1$ | $R_2T_2$ | $R_4T_4$ | $R_3T_3$ | $R_4T_4$ | $R_2T_2$ | $R_2T_2$ | $R_2T_1$ | $R_1T_1$ | $R_3T_3$ | $R_1T_1$ | $R_NT_N$ | $R_NT_N$ | $R_NT_N$ |

**CODE**

FOR RECORDING SKIN STATUS

$R_N$ = NORMAL SKIN COLOR
$R_1$ = SLIGHT REDDENING
$R_2$ = MODERATE REDDENING
$R_3$ = MARKED REDDENING
$R_4$ = MARKED REDDENING & SWELLING AND/OR OOZING

$T_N$ = NORMAL SKIN TURGOR
$T_1$ = SLIGHT DRYNESS
$T_2$ = MODERATE DRYNESS
$T_3$ = MARKED DRYNESS
$T_4$ = MARKED DRYNESS & CRACKING

OTHER INDICATIONS

5/ = PRODUCT ISSUED FOR TEST AFTER CHECK THIS DATE

/5 = PRODUCT UNDER TEST AS OF TIME OF CHECK

• = EMPLOYEE SHOWED SOME SENSITIVITY TO PRODUCT

Fig. 1.
Series I: Comparative study of protective silicone products on magnaflux operators.

product previously developed at our location, and three similar silicone products that had received a good deal of comment in current advertising or literature were assembled. These were obtained by direct purchase from wholesale drug suppliers or retail drug stores. The products were then placed in identical plastic containers and coded (alphabetically), so only the examiners would know which one was being assigned each subject.

The five products were then assigned to the various subjects, with the suggested product being given to those who appeared to be having the most difficulty (Fig. 1). All were instructed to wash and dry their hands and arms thoroughly, and then apply the product. They were to do this before starting their shift, at the break of the first half period, before returning from the lunch period, and at the break of the second half period. They were requested not to use any creams or lotions while away from their job, other than their normal usage.

In Series I the suggested product (B) soon proved to be outstanding (Fig. 1).

It is of note that one product (E) apparently caused a mild local reaction when applied by two of the subjects. Another subject's skin condition became so severe, while on one product (A), that she had to be removed from the job and placed under active clinical treatment. Three days later, even though her skin was not completely normal, she was assigned the suggested product and went back to her work. Fig. 1 shows the rapidity with which her skin returned to normal. Most of the subjects commented to the examiners that the suggested product seemed to keep the iron oxide powder out of the pores of the skin, and thus it was easier for them to keep their hands presentable. Also that it seemed more like a cosmetic than anything of its kind usually found in a plant.

When the results of Series I were reported to Industrial Hygiene Section Central Staff, it was suggested that we arrange a similar series with three additional products. Thus, Series II was started (Fig. 2). The only variation in procedures in this study from those in the first, was the manner in which the products were assigned. This time all subjects were assigned the same product at the same time. This study, however, covered only six of the original seven subjects, as one had been transferred to another department.

Though some difficulty was encountered owing to temporary transfers, vacation periods, and an operational shut-down, the series was completed. Of the three additional products, product "W" gave the best results prior to the operational shut-down, as products "X" and "Y" soon appeared to be inadequate. This product (W), therefore, was reassigned for use when the operation was restarted. It is of note that all the subjects, when checked at this renewal of the study, showed normal skin status compatible with their having been off the job for the three-months period. Within four days, however, all of them had reached, or were approaching, an advanced stage of difficulty.

They were then placed on the suggested product (Z), and their recovery was rapid (Fig. 2).


## Summary

A SUGGESTED silicone product was studied, along with six other similar products currently on the market and one developed at our location, in




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| NO. | CASE | PRETEST CHECK 7-16 | CHECK NO. 1 7-18 | CHECK NO. 2 7-20 | CHECK NO. 3 7-23 | CHECK NO. 4 7-25 | CHECK NO. 5 7-27 | CHECK NO. 6 7-30 | CHECK NO. 7 8-1 | CHECK NO. 8 8-3 | CHECK NO. 9 8-6 | OPERATION SHUT DOWN 8-8/10-29 | PRETEST CHECK 10-30 | CHECK NO. 10 10-31 | CHECK NO. 11 11-1 | CHECK NO. 12 11-2 | CHECK NO. 13 11-7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | AW + N-44 | X/$R_1T_1$ | $R_2T_2$/X | Y/$R_3T_2$/X | $R_2T_1$/Y | L | L | V | V | V | W/$R_NT_N$ | | W/$R_NT_N$ | $R_2T_1$/W | $R_1T_1$/W | Z/$R_3T_4$/W | $R_NT_N$/Z |
| 2 | AK + N-23 | X/$R_2T_2$ | $R_3T_3$/X | Y/$R_3T_3$/X | $R_1T_1$/Y | $R_2T_3$/Y | W/$R_3T_4$/Y | $R_2T_2$/W | $R_1T_1$/W | $R_2T_2$/W | $R_2T_4$/W | | W/$R_NT_N$ | $R_2T_2$/W | $R_2T_3$/W | Z/$R_3T_4$/W | $R_NT_N$/Z |
| 3 | LZ + N-61 | X/$R_1T_2$ | $R_2T_2$/X | Y/$R_2T_3$/X | $R_1T_N$/Y | $R_1T_2$/Y | W/$R_3T_3$/Y | $R_1T_2$/W | $R_1T_2$/W | $R_2T_3$/W | $R_1T_1$/W | | W/$R_NT_N$ | $R_1T_2$/W | $R_2T_2$/W | Z/$R_2T_2$/W | $R_NT_N$/Z |
| 4 | PK + N-24 | V | V | V | V | Y/$R_NT_N$ | W/$R_NT_N$/Y | $R_1T_N$/W | $R_1T_1$/W | $R_2T_2$/W | $R_2T_3$/W | | W/$R_NT_N$ | $R_1T_1$/W | $R_2T_2$/W | Z/$R_1T_3$/W | $R_NT_N$/Z |
| 5 | IH + N-34 | X/$R_NT_N$ | $R_NT_N$/X | Y/$R_1T_N$/X | V | V | W/$R_NT_N$ | $R_1T_1$/W | $R_1T_2$/W | $R_2T_2$/W | $R_1T_2$/W | | W/$R_NT_N$ | $R_1T_2$/W | $R_2T_3$/W | Z/$R_2T_3$/W | $R_NT_N$/Z |
| 6 | GK + N-31 | X/$R_1T_1$ | $R_2T_2$/X | Y/$R_2T_3$/X | $R_1T_1$/Y | $R_2T_2$/Y | W/$R_2T_4$/Y | $R_1T_1$/W | $R_1T_2$/W | $R_2T_3$/W | $R_1T_2$/W | | W/$R_NT_N$ | $R_1T_1$/W | $R_2T_2$/W | Z/$R_2T_3$/W | $R_NT_N$/Z |

**CODE**

FOR RECORDING SKIN STATUS

$R_N$ = NORMAL SKIN COLOR
$R_1$ = SLIGHT REDDENING
$R_2$ = MODERATE REDDENING
$R_3$ = MARKED REDDENING
$R_4$ = MARKED REDDENING & SWELLING AND/OR OOZING

$T_N$ = NORMAL SKIN TURGOR
$T_1$ = SLIGHT DRYNESS
$T_2$ = MODERATE DRYNESS
$T_3$ = MARKED DRYNESS
$T_4$ = MARKED DRYNESS & CRACKING

OTHER INDICATIONS

S/ = PRODUCT ISSUED FOR TEST AFTER CHECK THIS DATE

/S = PRODUCT UNDER TEST AS OF TIME OF CHECK

L = EMPLOYEE "ON LOAN" TO OTHER DEPARTMENT

V = EMPLOYEE ON VACATION

• = EMPLOYEE SHOWED SOME SENSITIVITY TO PRODUCT

Fig. 2.
Series II: Comparative study of protective silicone products on magnaflux operators.

two series of comparative surveys. In both series, the suggested product proved to be superior to any of those with which comparison was made. In retrospect, the comparative findings of these statistical studies set forth several factors which seem to need further rationalization or clarification.

Since other investigators have shown that silicones are dissolved by solvents and light oils, and since most of these products contained similar silicones, what was the basis for the suggested product's superior effectiveness? Assuming that the products formed a protective layer which the solvent acted upon, and thus spared the skin, all of them should have done the same, but apparently the suggested product did it better.

Assuming, too, that a more effective barrier was created by the four applications per shift, all of them should have done the same, as they were all used according to the same routine, but apparently, again the suggested product did it better.

Possibly part of the answer lies in the more favorable cosmetic acceptability found with the suggested product and commented on by the test subjects. Nevertheless, there was a superior result obtained with the suggested product. The reason is probably based on the fact that the right substances were mixed in the correct amounts, so that the end product best controlled the multitude of the factors inherent in such a problem as industrial dermatitis. It is worthy of note that the superior effectiveness and protection of the suggested product were shown not only in the end results, but also in its ease of application, flexibility of use, and the general preference for acceptance by the subjects. Further studies with many more subjects of both sexes are currently in process.

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# Mental Hygiene in Industry

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WITH EACH advancing year it is realized that more and more symptom complexes formerly considered to be organic in nature, are explainable on the basis of reaction to emotional tension, fear, frustration, and insecurity. These fears and frustrations, in some instances, lead to actual breakdown but much more commonly result in translation to physical symptoms which may be referable to almost any of the body systems and give rise to headaches, dizziness, stomach trouble, rapid heart and increased blood pressure, to extreme fatigue or even paralysis.

Emotional responses within the body were designed originally to prepare the body for fight or flight in the face of danger. In a complicated society such as we now have where one can no longer respond to emotion by physical fight or flight, these responses are expressed in different ways and can be very disturbing and the basis of a great deal of ill-health. Thus the observation that emotional ills appear to be disorders of increasing civilization.

The problem of emotional or mental ill-health within the industrial population is no small one. The actual incidence of disorders of emotion and morale in Canadian industry is not accurately known. It has been estimated, however, that such disorders account for as much as one-third of the total employee disability rate. It is known that about one-half of the workers who visit industrial dispensaries to seek advice about health problems have no demonstrable organic basis for their complaints. Of course it is also true that about 60% of the patients who attend outpatient departments of general hospitals do not suffer from organic disease.

In addition to its importance as a primary cause of lost time the effect of emotion and attitude on duration of organic illness and on rehabilitation is not inconsiderable. If one adds to this the effect of nondisabling unhealthy emotional reactions on efficiency, morale and cooperation on the job the importance of the subject in relation to over-all industrial efficiency is almost overwhelming.

What is our definition of mental health? Mental health implies an ability to live in harmony with one's environment. It implies the ability to survive, to compete, and to discharge one's responsibility in relation to personal capacities, to get along with people, to acquire skills which are consistent with ability, to obtain satisfaction, to accept and to live with or overcome personal limitations, and to accept the consequences of one's behavior. It may be important to point out that environment must be included in any definition of mental health. There are always the two variables, the individual and the environment. It may be important to point out that regardless of the qualities of the individual there are some environments in which a high level of mental health cannot be achieved.

One of my teachers would greatly simplify the definition of mental health by equating it to happiness and in turn to security. He would define mental ill-health as unhappiness and a feeling of insecurity. Under such a definition it can be readily seen that mental health is a relative state since no human is completely happy or completely secure or completely self-sufficient. This is not to be interpreted that few are mentally healthy. Some insecurity, and some unhappiness must be regarded as a normal rather than an abnormal state.

What are the causes of mental or emotional ill-health? Those interested in the subject quickly come to realize that there is never in a given case one single causative factor, as was once thought. The cause never appears as a bolt from the blue, nor as a mysterious entity destined to implant itself at a particular period on unprepared soil; the cause is a process—something that moves and shapes itself in the passage of time. It doesn't just happen. The effects of heredity, child guidance and habit training, of the environmental influences and experiences in childhood and youth, of physical health, culture, etc., all have a bearing on ultimate emotional stability. Surely this concept of etiology provides increasing incentive in our urgent desire to promote mental health and to prevent mental ill-health. That we have a long way to go in mental hygiene is suggested by the large number of our people who achieve chronological maturity while still retaining emotional immaturity to a degree that interferes with their ability to live in harmony in the situation in which they find themselves.

On the bright side, however, we have accumulating evidence to suggest that *behavior can be predicted and that the process of personality maturation can be influenced.* There is now good reason to believe that a child who is loved will almost invariably be capable of loving others. There is now ample evidence to show that a child who has not had love will be hostile and will lack trust in people. There is now good reason to believe that a child who has been over-protected, never allowed the opportunity to develop independence appropriate to his age, will be neurotic and dependent. There is good reason to believe that a child who grows up in association with people who have respect for the rights of others and the laws of society, will also have

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XUM

respect and consideration for the rights of his fellowmen. There is good reason to believe that a child who has been rejected will usually be resentful, often delinquent and always insecure. Much progress has been made in the area of child guidance. Our mental hygiene activities must not stop with parent education and teacher training but must be extended throughout adult life. The maturation of personality does not stop with the cessation of physical growth. Under favorable conditions it may extend throughout adult life.

DO THESE fundamental mental health observations have any bearing on the mental health of industrial workers? Are industrial workers susceptible to the effects of love, recognition, rejection, over- and under-protection, satisfaction, rewards, and discipline? We know that adults on the surface are more sophisticated. We know that they have been conditioned by all previous life experience. In spite of this, my observations would lead me to believe that the fundamental responses to love, protection, rejection, recognition and other forms of stimuli remain relatively unchanged in the industrial population. That workers individually and collectively like to be recognized, like to have at least a measure of control over their own affairs, like to have the opportunity to develop skills appropriate to their individual capacity, and through the acquisition of skills to enjoy a measure of independent security, unfortunately is a relatively recent discovery in industrial society.

Observation would tend to suggest that the mental health needs of people in industry are not fundamentally different from in the home. Just as parents are now recognizing the importance of participation, responsibility, example, and discipline in child development, so industry is now beginning to look at the advantages of providing those conditions of work which foster the development of employees who are mature, and who are capable of independent thought and action. This is, of course, quite foreign to the master-servant era now disappearing from industry.

That we have not progressed too far along this road as yet is emphasized by the fact that a great industry in the great country to our south recently announced that employers could and probably should bargain with labor unions in good faith. That this is considered a new concept of bargaining in some industries suggests we have a long way to go.

Employees like to be recognized. Employees like a democratic opportunity to advance and to acquire independent security consistent with their skills and efforts. That work in industry should be a method rather than just a means of living is a new concept fundamental to industrial peace and mental health.

The mental health needs of workers are intimately related to the work situation. The acute emotional reaction which gives us windy indigestion, clammy hands, rapid heart and difficult breathing, for example when one has to give a speech, does little or no harm to health. Chronic emotional response to a grievance or to frustration or to continued fear or to lack of job satisfaction, undermines health, produces inefficiency, and brings about a desire for a change in the order of things. Chronic anxiety undermines health. It is true that chronic anxiety related to situations off the job, such as a mother-in-law in the home, an unhappy marital situation, debt, or an invalid child, may affect the health and efficiency of the worker. Observation would lead one to believe, however, that one reason they do affect efficiency is because they impair ability to make an adequate adjustment to the work situation. The importance to the career worker of a satisfactory job situation is such that if he achieves satisfaction in his job his private conflicts become of secondary importance. In talking with many people it is found that problems of living and of mental ill-health tend to fall into one or more of six major areas. These are vocation, avocation, social relationships, sexual experiences, philosophy of life, and finance. This thesis cannot be proved, few psychological concepts can be proved beyond doubt, but there is a good deal of evidence to suggest that the opportunity to acquire skills through vocation and avocation is probably the most important single factor in mental health in our competitive society. The more skills we have the more independently secure we are. It is more difficult to take away our skills than to take away any other possessions. Our skills are our greatest source of recognition and our main hope of immortality. People can stand great adversity and still be happy if acquiring skills and progressing toward a goal.

Work and the work situation, therefore, are important to mental health. As would be expected, they are also important as causes of mental ill-health. Of all the mental health problems seen in industry it is probably true that tensional states are by far the most common. Many tensional states are caused by work and the work situation. I thought we might discuss some of the factors in industry which lead to excessive tension, and say a word about prevention.

This part of the paper is based both on personal observation and on a series of discussions on industrial mental health held recently at McGill under the chairmanship of Dr. D. E. Cameron, Professor of Psychiatry, McGill University..

TENSION is spoken of rather glibly and yet it is difficult to define. Dr. Cameron defines tension as a state of "preparedness for action." This is a practical definition. The physiologists have for years used the word "tone" to describe the state of a muscle which enables it to act efficiently and immediately in response to the will. Preparedness for action is a desirable state and, as would be expected, is related to efficiency. A muscle which is without tone is clumsy and ineffective when called upon to undertake precise movement. Likewise the person who is not prepared for action is ineffective. We all recognize the fellow who has a healthy level of tension, who is prepared for action. He is referred to as a self-starter. The coach says he is on his toes. The foreman likes to have him in his gang. Some people have a low tension level and require continual prodding. They are usually inefficient.

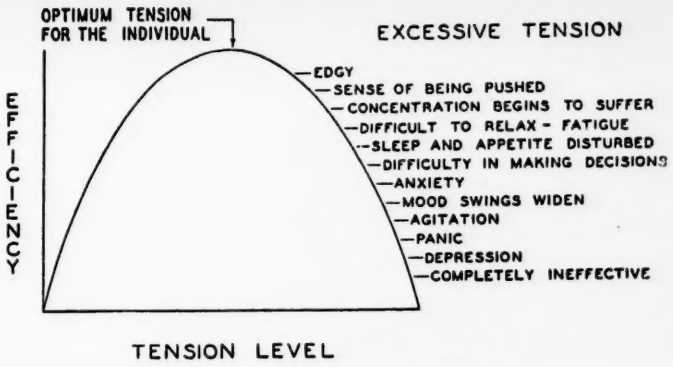
The following figure shows graphically the relationship between efficiency and tension level. As ten-



XUM

sion is raised efficiency increases, but if increased beyond the optimum, efficiency goes down.

The responsibility of industrial management is to maintain the tension of employees at an efficient level. As Canadians we try, through private enterprise, to keep the tension level of our population at a level which enables us to compete successfully in world affairs. Sometimes we fail to realize that when the tension level is raised too high efficiency goes down. Excessive tension, when prolonged, not only reduces efficiency but also undermines health.




Effect of tension on employee efficiency.

The effective person is the person who can maintain his tension level at or near peak efficiency. He will occasionally get the wheels going too fast and then cut back a bit as he notices that he becomes edgy or irritable and not quite so effective. To some, such symptoms are merely a signal calling for greater effort or increased activity. When this occurs a vicious circle is established with productivity going down and tension going up. Under these conditions typical symptoms develop. Concentration begins to suffer. Relaxation is impossible. Fatigue develops. Adrenalin is pumped into the blood stream too fast. This is the fear reaction. Sleep and appetite are disturbed. The heart may start to pound. Decisions become increasingly difficult. With indecisiveness comes real anxiety followed by depression, a feeling of hopelessness. Agitation usually precedes panic. At this stage hospitalization is usually indicated.

Now relatively few people go through the entire cycle, but, a great many industrial workers do get over into dangerous tension levels with adverse effects both on productivity and on health. Because they cannot get through their work during the day they still take the briefcase home at night.

The ability to withstand tension varies markedly from person to person. It is important to realize that everyone is susceptible to unhealthy tension levels under certain conditions. Everyone has a breaking point. In some, the tension tolerance, for one reason or another, is very low. The mere effort of living, even in a protected environment, may produce disabling tension levels in some people. Such people usually require the protection of the hospital environment to survive. At the other end of the scale some can apparently withstand almost endless tension-producing stimuli with surprisingly little in the way of impairment to efficiency.

What causes the wide variation in the susceptibility of people to tension? There may be hereditary factors. These do not seem to be very important. Most of us would agree that environmental influences are more important in determining our personality development and our ability to withstand tension. We have certainly all noticed the effect of environmental factors such as climate and racial customs on tension level. The ability to withstand tension depends on all of our past experience, including our habit training, our opportunities to accept and deal with responsibility, our intellectual capacity, our physical health, and undoubtedly on our philosophy of life.

There are certain groups of people who are characteristically susceptible to tension than others:

1. *The physically handicapped* as a group do not stand tension well. The blind, the deaf, the disabled compete unfavorably both socially and economically, and unless they possess unusual personality maturity tend to be tension prone.

2. *Older people tend to be tension prone.* Our society tends to discard age and experience in favor of youth and technological advance. Older people are at a disadvantage and they tend, for this reason, to be tension prone. There are many reasons for this. Often older people in industry have not achieved goals they set for themselves. They have become less adaptable. Often they have devoted a major portion of their lives to one business and they may resent new authority. The preretirement group are particularly susceptible to tension and require careful and extremely considerate leadership.

3. Those with certain *personality characteristics* are tension prone. Those who lack confidence, those who are hostile and do not trust people, those who find it difficult to work with people, those who are easily frustrated or are highly sensitive and susceptible to guilt are prone to excessive tension.

4. The type of motivation in the individual has a bearing on susceptibility to tension. Those who are overmotivated are impatient and tension prone. Those who are poorly motivated are tension prone if prodded. Those with conflicting motives tend to be tension prone. Those who are overmotivated who also have limited capacity, are particularly susceptible to tension.

So people vary in their ability to withstand tension. The process of living inevitably produces contact with tension-producing stimuli. These may be related to problems in the home, in the community, or at work. In the industrial situation tension-producing stimuli may be found in the job or in the work situation. Some jobs produce more tension than others. Some of the factors in jobs which are tension-producing may be listed:

*Responsibility Factor:* The amount and kind of responsibility has a bearing. Strangely enough jobs with not enough responsibility will produce excessive levels of tension in aggressive people just as



XUM

readily as jobs with excessive responsibility. In this connection industry has an obligation to keep people busy. Jobs involving responsibility for people tend to have a high tension rating. Thus probably the justification for higher rewards on management jobs. Jobs requiring the coordination rather than command of the thoughts and actions of people have the highest tension rating. In regard to responsibility it is important to realize that when it is clearly defined it is much less tension-producing than indefinite or ill-defined responsibility. Responsibility accompanied by authority is less tension-producing than responsibility which is devoid of authority. These are important considerations in industrial organization and in placement.

*Physical Factors:* Where the physical demands of the jobs are beyond the physical capacity of the worker tension is prone to develop. This is readily observed in the older or handicapped worker. Job factors such as high noise level, vibration, exposure to heights, proximity to electrical currents, or other danger, tend to increase tension levels.

*Unpredictable Flow of Work:* Surges of responsibility and work load seen both at the executive and the production level affect tension. The adverse effect is exaggerated if the cause of the change of pace is either unknown or thought to be unjustified.

*Intellectual Requirements:* Jobs requiring either more or less capacity than the individual has tend to produce insecurity or boredom with resultant unhealthy tension levels.

*Deadlines:* The deadline job is typically tension-producing. The incidence of alcoholism in certain occupations noted for their deadlines is sufficient evidence of their tension-producing characteristics. Alcohol is the most readily available tension-reducing agent in our society.

*Creative Jobs:* Creative jobs, particularly those in which the individual may not see the results of his efforts in direct relationship to his efforts, are tension-producing. The staff type of job has a high tension rating for this reason.

*Repetitive Craft Jobs:* High speed repetitive jobs usually demand only a limited range of the workers' skills. In addition they may have little meaning to the worker and are tension-producing. Fragmentation of work operations leads to less and less opportunity for the development of useful skills. This is a major problem in considering the mental health of our industrial population and it is becoming more serious.

These are some of the factors in jobs which affect the tension level of workers.

*The job setting* also has a bearing on the tension level of workers and management. Some important factors in the job setting may be listed:

*Supervision:* Management's job is to keep the tension of working people at an efficient level. If it is too low production suffers. If it is too high both production and health suffer. The leadership ability of the supervisor is important in this regard. When employees lack confidence in the boss the tension level of the entire group is affected. If the boss is a poor leader, if he discriminates, if he fails to recognize good work, the tension level is affected and production goes down. *Good supervision will go a long way toward maintaining healthy levels of tension on any job.*

*Rigid job standards* tend to raise tension levels. This is particularly so if the need for such rigidity is not understood or accepted by the employee.

*Nonacceptance:* In group activities it is essential to be and feel a part of the group. An employee who feels that he is not accepted by the boss or by the group or even by the customer will be inefficient and tension prone. A boss who is not accepted by subordinates will develop unhealthy tension.

We have reviewed at some length factors which influence tension level. We have talked about variations in susceptibility to tension. We have discussed the adverse effect of tension on physical and mental health and on productivity. What can be done about it? How can we develop working conditions which will avoid these undesirable results?

It is important again to state that an optimum level of tension is essential. In fact industrial management has an obligation to keep the tension of industrial people at an effective level. This is not only healthy for the industry but there is some indication that it is also healthy for employees. However, the prevention of unhealthy or inefficient levels of tension is one of the big challenges in our industrial mental hygiene program. This brings us to a discussion of desirable mental hygiene activities in industry and in industrial communities.

COMPANY POLICY: The mental health program of any company starts with its broad policies of administration. Those policies which enhance the qualities of the individual by contributing to his satisfactions and his recognition, those which encourage his participation and foster his growth and development, contribute to his mental health. Those policies which degrade the status of the individual produce anxiety, feelings of tension and insecurity, and inevitably result in mental ill-health. Such policies tend to lower morale and produce high absence rates. They promote countervalent group reactions, such as the labor movement, which are designed to resist the introduction of additional degrading policies and to replace such policies by those which contribute to at least a measure of material security and human dignity.

LEADERSHIP: Just as the major share of responsibility in child guidance has fallen on the shoulders of parents and teachers, so the burden of mental health and morale in industry must fall on the shoulders of management people. They are the leaders of our industrial organizations. All group effort depends on organization which demands leadership. Leadership may be defined as the skill in developing cooperative effort. Good leadership is probably the most important single factor in any industrial mental hygiene program. Good man-management is a skill requiring great ability and wide experience. Leaders are not born. They acquire their skills by training and doing. The selection and continued training and development of management people is probably the most important challenge confronting Canadian industry today. It is a fact that the crucial interpersonal relationship on the

job takes place between the worker and the first level of management. The man and his boss. Unfortunately the first level of management, the foreman, is usually the least experienced. A foreman may or may not have special aptitudes of leadership. He often has not had extensive training and certainly is not likely to have had wide experience in leading people. In this connection it may be significant, although many factors have a bearing on the subject, that peaks of industrial unrest have coincided with periods when large numbers of new management people have been created, e.g., the boom periods.

CONDITIONS OF WORK: Working conditions which provide, among other things, freedom from discrimination, a democratic opportunity to advance, work assignments which are meaningful and lead to the development of useful skills, a healthy degree of security, and rewards which are roughly commensurate with effort, are fundamental to morale and to mental health.

PLACEMENT (VOCATIONAL GUIDANCE): The ability of workers to acquire skills and to produce varies in relation to their capacity, motivation and persistence. Careful placement of employees on jobs which they can do and from which they can gain satisfaction is a vital consideration in mental health. When an employee is placed on a job which is beyond his ability he becomes insecure and unhappy through lack of accomplishment. He cannot acquire the required skills and he is insecure. On the other hand an employee obtains little in the way of lasting satisfaction from acquiring skills which require only a limited portion of his ability. The challenge in placement then is to ascertain the interests, abilities and aptitudes of employees, and to place them at jobs to which they are physically and mentally suited.

EMPLOYEE DEVELOPMENT: The challenge in employee development is to discover and to develop to the optimum the potential skills of all members of the work force.

TRAINING: The training of employees, including induction into the business and into new assignments, does a good deal to overcome the insecurity and tension which always results when people find themselves in new situations. Job training is extremely important in facilitating the acquisition of required skills. Management training, including such subjects as human relations, observation and study of human behavior, conference leadership, communication, interviewing, administration, etc., offers tremendous opportunities for improving the leadership skills of our industrial leaders.

INDUSTRIAL MEDICAL SERVICES: *Diagnosis and Placement:* The early recognition and suitable placement of the tension prone is important in the maintenance of health and production. Ready access to health counseling services makes possible the early diagnosis of conditions which might lead to disability. The preplacement examination, the periodic examination, and the dispensary visit provide important opportunities for preventive work on an individual basis.

*Treatment:* Prevention and case-finding are the important part of the health job in industry. Continued treatment of disabling mental health problems is the job of the private physician, the consultant, the clinic, or the hospital. Emotional first aid measures, however, can often prevent breakdowns requiring prolonged therapy. In the average dispensary industrial physicians and nurses undertake much more counseling in relation to mental health problems than to organic disease. For this reason health workers in industry are relatively ineffective unless they are students of human hehavior.

*Education:* You cannot teach mental health. Assistance in personality development, through counseling, is constructive. Those who like people can readily become students of human behavior and with sufficient experience can learn to interpret in a nontechnical way the significance of behavior patterns. The training of line management, personnel and health staff in this field is particularly valuable in the mental hygiene program within industry.

*Rehabilitation:* The early and safe return to work following illness, organic or otherwise, is an important consideration in the maintenance of industrial health. Disabling injury or disease always produces insecurity. The mental health factors are usually the major consideration in industrial rehabilitation programs. They are much more difficult to deal with than organic factors. Rehabilitation following major mental illness is a problem requiring a highly coordinated effort.

COMMUNITY RESOURCES: All mental hygiene activities in the industrial community contribute either directly or indirectly to the mental health of the industrial population. The child guidance clinic has as its objective assisting in the development of mature adults who will ultimately take their place of responsibility in industry. The general practitioner is concerned with the physical, mental and social well-being of his patient. The psychiatric clinic is prepared to assist in the diagnosis, treatment and follow-up of those who develop mental health problems. The trained social worker, the public health nurse, the psychiatrist and all professional groups who are interested in the problems of living contribute to the over-all mental health of the industrial worker, who now represents almost one out of every three persons in our Canadian population.

That health, morale, and industrial efficiency are inseparable is a well-established fact. That the maintenance of emotional health offers the greatest challenge to industry, to industrial medicine and psychiatry, and to public health, unfortunately has been recognized only recently. That a man's job and his relationships to his confreres and to his leaders within industry are crucial factors in determining his mental health and morale requires much more attention. That industrial medicine, psychiatry, and public health workers might devote a larger proportion of their efforts to this phase of health conservation is presented for your consideration.



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# Industrial Medical Association

## *President's Page*

OUR IMA COMMITTEE on Public Relations is charged with a task of utmost importance to each Association member, as well as to our field as a whole. This Committee currently consists of the Chairman with four "nucleus members" and nine corresponding members. The corresponding members are the Chairmen of the Public Relations Committees of the Component Societies where such Committees exist, or the Secretaries where there are no such Committees.

The functions of the Committee on Public Relations are to promote a better knowledge and appreciation of industrial health concepts among fellow physicians, labor, management, and the general public; and to assist in publicizing the IMA Annual Meeting.

John J. Poutas, M.D., was appointed Chairman of this Committee in April, 1953, and served faithfully and well. He relinquished the chair in April, 1957. Obstacles were many, and closely spaced, but Dr. Poutas met them successfully. He was the first to point the way to effective collaboration with other important associations, medical and lay. In April, 1957, Thomas G. Rigney, M.D., who had been a member of this Committee, was made Chairman. Dr. Rigney is a likely successor to this all-important assignment.

The Committee held a preliminary "nucleus meeting" in St. Louis, April 25, 1957. The retiring Chairman, the President Elect, the First Vice President, and the Publisher of the Journal were in attendance. Realistic recommendations, which should be fruitful, were made as follows:

1. That this Committee have on its roster a member from Chicago to act as liaison with the Journal, and with the office of the Association's Managing Director.

2. That geographical representation within the Committee membership and liaison be established between Component Societies and District Counselors.

3. That the Committee have a member from the city wherein the Annual Conference will be held, to act as liaison with the Conference Publicity Committee.

4. That each Component Society have a separate Public Relations Committee.

5. That the public relations endeavors of the Editor and the Publisher of the Journal in the interest of public relations at local membership level be continued and expanded.

"GRASS ROOTS" public relations should be the constant endeavor of all. This was well expressed by R. T. Johnstone, M.D., in his "Let's Talk about Ourselves" (*Indust. Med. & Surg.*, 26:8, 400 (August) 1957). Some of Dr. Johnstone's pungent sentences could well be daily reminders:

"It is extremely disconcerting to have a member of our own profession ask 'What is occupational medicine?' . . . . For reasons of our own doing, and some that are not, we have failed to develop adequate avenues of communication with our confreres, our educators, our students, and even that specific segment which we serve, the employee and employer of industry . . . . It seems to me that a tentative solution lies in personal evangelism, in daily preaching our gospel for the purpose of conversion. We should talk about what we do . . . . To be effective, of course, we must first of all believe in ourselves, and take pride in our specialty . . . . It is high time that we define our activities, discard our inferiority complex, and discontinue the idea that we are members of an unwanted minority group."

OUR COMMITTEE on Public Relations can be relied upon to do an excellent job. Already a good start has been made toward the 1958 Conference. But, in its broader areas, the Committee will welcome all the help it can get. Therefore, let us consider Public Relations effort a continuing assignment for every one of our more than 3500 members. Together, we are a *big* Committee — for a *big* Purpose.

Jerome W. Shilling M.D.

# Letters

## Complete, Continuous, and Successful

TO THE EDITOR: Last month you presented an article by Dr. John H. Ganschow, Medical Director of this General Motors Division, in which he described the Chevrolet-Detroit Gear and Axle eye-protection program *(Indust. Med. & Surg.*, 27:9, 405 (September) 1957). That program has been appraised from the point of view of the Safety Department, and leads to various observations complementing Dr. Ganschow's report. Hence this letter is written.

Our plants, with an average payroll of just under 10,000 employees, have provided eye protection on selected occupations for years. But eye injuries and losses continued at an alarming rate — almost predictable based on past averages. A survey was made that showed, almost without exception, eye losses arising not out of a regular work assignment with a recognizable eye hazard such as welding, cutting, burning, chipping, snag and finish grinding, etc., but from other types of work assignment. Predominating causes were nearly always traceable to a situation that was abnormal. The employee's statement invariably read something like "the piece of stock stuck and I hit it with a steel bar." These incidents appeared to follow a pattern outside the range of recognizable eye hazards such as the occupations listed.

The need for a positive end to this type of disabling injury was obvious.

A series of meetings of the conference or round table type was arranged to include all members of supervision from all plants and shifts. These meetings were limited to no more than 20 supervisors, headed by the Safety Director. It had been agreed, previously, that all members of supervision must be thoroughly sold on the need for an eye protection program and encouraged to take an active part in educating the employees.

Types and styles of safety glasses were discussed and agreed upon. Five-minute safety talks were scheduled for the employees by their group foreman. The success of this method of persuasion as opposed to a directive, ordered method of cooperation was soon apparent. Within 90 days, 84% of all employees were wearing the provided eye protection on a voluntary basis. (All members of supervision began wearing eye protection from the start of the educational program.) At this point it seemed appropriate to establish a definite date for compulsory eye protection.

Therefore, early in January, 1954, memoranda were prepared, carrying the plant manager's signature, for posting on all time clocks and bulletin boards, proclaiming February 15, 1954, to be the starting date when *"No admittance to the plant without eye protection"* would be the rule.

These memoranda were given greater emphasis by prepared metallic signs at all plant entrances, side doors, truck gates, receiving docks, etc., carrying the same legend. In addition streamer type banners 5 ft x 10 ft in size were hung in all plant entrances repeating the same message. The eye protection program went into full force with a minimum of confusion.

During the process of initiating this program several decisions were reached that would influence it for the better. These were:

1. Management must be firmly behind the program and indicate this position by positive word and action.

2. An extensive educational program must be carried on beginning with all members of supervision before starting employee training. Every advertising or promotional medium available should be brought into play. We used, in addition to the banners, signs and memoranda previously mentioned, a series of flip chart lectures, posters (purchased and home-made), film slides, movies, employee statements, and many other incidental visual aids.

3. Follow-up sessions are a "must" with supervision, tool setters, die setters, and other employee groups.

4. A method of handling both plano and prescription safety glasses must be arranged.

Even with the wholehearted support of all employee groups who accepted the program in its entirety, many factors were found that needed smoothing out to make it satisfactory. Not the least of these was the question of the style of the safety glasses and the proper fitting of the employee. A particular style seemed best suited for general wear.

Interchangeable lens, temples, and frames seemed best and were accepted by the employees. Fitting was accomplished by actual measuring and personal fitting. The fitting program continues on a daily basis and, since all frame sizes, bridge sizes and styles, temple lengths and styles are available, the question of an improper fitting is eliminated.

Labor turnover and damaged glasses require extensive repair, cleaning, and sterilizing before reissue. Lens replaced, temples replaced, cleaned and repackaged in sealed cellophane containers — all these are a "must." Containers are size-marked for easy issuance.

Safety glasses (and we prefer this terminology rather than "goggles") were originally issued to each employee. Subsequently, since no plant admission without eye protection is permitted, an employee who loses his safety glasses is required to visit the plant protection office before entering the plant to sign for a new pair. A nominal charge is made for lost glasses.

In contrast to the plano program, prescription ground glasses become the permanent possession of the employee. The program begins with the group supervisor who supplies the employee with a prescription blank for completion by a physician of the employee's choice, and a cover letter explaining the program. The employee returns the prescription to the Safety Department, which authorizes the glasses made up. Delivery and fitting of the glasses are accomplished along the same lines as for plano safety glasses. The employee is urged to return to his physician for whatever checking and fitting may be indicated. We are of the opinion that any prescription safety glass program must be handled on a high professional level, and nothing



XUM

injected into it that would detract from the patient-doctor relationship. Since the inception of our program we have insisted upon this relationship, and we believe this to be responsible for the willingness of the physicians in the area to cooperate with us.

The eye protection program has been in effect for over three years, and the results have been most gratifying. No lost eyes, no loss of vision, no lost time from eye injuries — and the innumerable daily visits to the plant Medical Department for the removal of minor foreign bodies, eye washes, inflammation, etc., have been reduced by better than 91%.

To maintain the program, and the results that we have proved are attainable, the regular use of safety talks, posters, exhibits, and the best equipment available is necessary. We consider our program now complete, continuous, and successful.

—C. W. HALSEY, Safety Director,
Chevrolet-Detroit Gear & Axle Division,
General Motors Corporation.

# Books

## Teaching Safety to Safety Teachers

SAFETY EDUCATION: A. E. FLORIO and G. T. STAFFORD. McGraw-Hill Book Company, Inc., New York, 1956, pp. 327, $5.50.

In the case of calculus there is little uncertainty as to where it belongs in a curriculum. It does not belong in the second grade and everyone knows that. When it comes to education in safety a need exists in the kindergarten as well as in gerontology and at every intermediate age. These authors are well aware of this, perhaps are troubled by it, but carve out for themselves safety education for school-aged children, which term includes both elementary and high schools. The preface includes this language:

"Accidents, however, remain the foremost cause of death among school-aged children, accounting for many more fatalities than are attributed to any single disease. Home and traffic accidents claim the most lives, but drownings and fire casualties also help to keep the death toll high. Automobiles, electrical appliances, and other modern machines, while unquestionably adding to the enjoyment of life, have also multiplied its dangers, and man has not yet learned how to function safely in his increasingly hazardous environment. Although welcoming new technological developments, he fails to adopt the careful procedures that alone can protect him from the risks inherent in using the powerful equipment now at his disposal. The mechanical safety devices designed to compensate for these risks have therefore been unable to lower the accident rate to the extent that antibiotic drugs and other scientific advances have reduced the number of disease fatalities.

"Preventing accidents is not a simple matter, for so many variables affect the accident rate that it is difficult to determine the most effective remedial action. But since human error is probably the outstanding cause of 85% of all accidents, education for safe living seems the best approach to the problem of minimizing them. The fact that safety education has thus far had only limited success suggests that greater effort is needed, not that the method is wrong. Although the field is still new, excellent results have already been reported in those areas that have received primary emphasis. This book holds that the scope of safety education must be enlarged to embrace all areas of living—the home, the factory, the farm, the school, and the community, man's hours of work and his hours of leisure."

In that area the contributions made are characterized by facility. Of 14 chapters the one on psychological consideration affords for one reader the most appeal. The first paragraph therein reveals the trend. "Although nearly everyone knows that smoking in bed, speeding, crossing streets without first looking in both directions, and similar careless habits cause innumerable deaths and injuries, these practices are still widespread. Obviously, school personnel cannot hope to teach people to behave safely merely by publicizing accident facts and explaining precautionary measures. Since learning is strongly influenced by motives, emotions, and attitudes, safety education cannot be effective unless these forces are utilized to support its objectives."

In the language of the reviewer and not that of the writers, this book is for the teaching to teachers of how to teach safety.

## On Rehabilitation

REHABILITATION LITERATURE, 1950-1955: EARL C. GRAHAM and MARJORIE M. MULLEN. The Blakiston Division, McGraw-Hill Book Company, Inc., New York, 1956, pp. 621, $13.00.

This bibliography indexes and annotates 5,214 periodical articles, pamphlets, and books relating to the medical care, education, employment, welfare, and psychology of handicapped children and adults. It brings together in one alphabetic listing, by subject, references published in the six-year period from January, 1950, through December, 1955.

Approximately one-half of the references are identified with the medical and associated therapy fields. These references will be found chiefly in libraries serving medical and paramedical groups. The other references are fairly equally divided among the other professional areas of rehabilitation, such as special education, psychology and mental health, social service, parent education, recreation, vocational guidance, and employment. These references will most probably be found in the general collections of public, college, and university libraries.

Brought together in this volume are not only references in the different professional specialty areas, but also references bearing on rehabilitation in the various disability areas, including cerebral palsy; brain injuries; mental retardation; impairments of hearing, sight and speech; heart disease; poliomyelitis; chronic disease and the aged; arthritis; epilepsy; amputation; tuberculosis; hemiplegia, paraplegia, and quadriplegia; aphasia; multiple sclerosis; muscular dystrophy; Parkinson's disease; and other congenital and acquired diseases and handicapping conditions.



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## The Iowa Breakfast Studies

OVER A PERIOD of eight years a series of studies on breakfast eating habits has been conducted in four universities. Twenty scientific papers have grown out of this series which have come to be known as "The Iowa Breakfast Studies." One investigation led to the following conclusions as to the why of more than a skimpy breakfast.

The omission of breakfast was demonstrated efficiency in the late morning hours, which is reflected in poorer physiologic performances.

The ommission of breakfast was demonstrated to result in poorer attitude toward school work and to detract from scholastic attainments.

Coffee alone is not a good substitute for breakfast, since efficiency in the late morning hours is less than when a basic breakfast is eaten.

The content of breakfast is not a determining factor in the efficiency of breakfast so long as the morning meal is basically adequate from the standpoint of its nutritional content.

The basic breakfast defined as providing one-fourth the daily caloric requirement and one-fourth the daily protein allowance is superior in maintaining efficiency in the late morning hours, when compared either to larger or smaller morning meals.

The importance of protein in breakfast was studied on the basis of the part which it played in the maintenance of the blood sugar above the fasting level in the late morning hours. The investigation showed that 20 to 25 gm of protein were adequate in this respect, 15 gm protein were on the border line, while 10 gm protein were inadequate to maintain the blood sugar significantly above the fasting level in the late morning hours.

In addition, it was shown that protein from animal sources, protein from plant sources, and mixed protein were equally effective in maintaining the blood sugar significantly above the fasting level in the late morning hours.

The specific dynamic action of protein from animal sources was not significantly different from that of plant sources.

In the cases of diabetic patients studied, who were maintained on N.P.H. insulin, 25 gm of protein in breakfast, either of plant or animal origin, were adequate to maintain the blood sugar significantly above the fasting level for 2½ hours and to prevent it from falling below the fasting level for at least 3½ hours.

The omission of breakfast is no advantage in a weight-reduction-diet regimen. In fact, it is a disadvantage in that those who omit breakfast not only accentuate their hunger, but also suffer a significant loss of efficiency in the late morning hours.

A bedtime snack consisting of cereal, milk, and sugar is useful for alleviating hunger both in the late evening and early morning hours. This is especially true in the case of those persons who have a tendency toward omitting breakfast, or eating a small morning meal. The contribution which the cereal and milk snack makes lies not only in the calories provided, but also in the protein it supplies.

The responses of the aged to the various breakfast regimens studied established the fact that for the most part, the same nutritional principles apply to the aged and young alike, and that the aged are eager and capable of eating a nutritionally sound breakfast if they are properly motivated, and if it is made available to them.




XUM

The utilization studies involving nitrogen, calcium, phosphorus, and iron showed that from a metabolic standpoint the content of the basic breakfast and the breakfast regimen did not significantly alter the utilization of these essential elements. The studies concerning the effect of the breakfast regimen on the excretion of thiamine and niacin demonstrated that the excretion of those elements was not significantly affected by the breakfast regimen.

During the course of the studies on the role of breakfast in the diet regimen, an adequate breakfast, designated as a basic breakfast, was established. The basic breakfast is defined as one that provides one-fourth the total daily caloric requirement and one-fourth the total daily protein allowance. The basic breakfast is designed as a guide by which a nutritionally adequate breakfast can be calculated for any individual, by adjusting it both calorie-wise and as to the protein allowance. This adjustment is made on the basis of the nutritional requirements necessary to maintain any desired nutritional level.

## Multiple Cancerigenic Agents

INVESTIGATORS at the University of Wisconsin's McArdle Memorial Laboratory provide this present estimate of atmospheric cancer-producing agents: Polluted air is a common carrier for many carcinogens—soot, oxidized products of gasoline vapors, and radiation—and "taken singularly, below the chemical's threshold, each one of these substances may have little effect. But, when they combine forces, can certain carcinogenic agents in man's environment supplement each other—as has been shown with mice? We already know that cancer is more likely to attack people who are overweight than those of normal weight. For some unknown reason, the metabolism of an overweight person makes him less resistant to cancer." Soot—a product of incomplete combustion and a recognized carcinogen because of the hydrocarbons it contains—escapes into the air from many sources, such as the exhaust pipes of automobiles, factory chimneys, and even the small rubbish fires of a tidy homeowner.

"When you smoke a cigarette, available oxygen cannot burn the cigarette completely, incomplete combustion results, and carcinogens are produced. Throughout the machine age, products of incomplete combustion have been with us in increasing quantity. Consequently, we now come into contact with more carcinogens than ever before." When susceptible mice are treated with soot hydrocarbons and later x-rayed, leukemia results. A similar reaction may result in man although there are no data available to settle that question.

Ultraviolet rays from the sun, as evidenced by the high rate of skin cancer among sailors and farmers, provide still another type of carcinogen.

If man is exposed to a small quantity of one carcinogen, there is little danger of it doing him harm as long as the chemical's quantity does not reach its threshold or damaging strength. "But there is an additive danger. Small amounts of different carcinogens, if they work together, may greatly increase man's danger. An unfavorable area is a city with smog problems where many carcinogenic contacts are possible."

The role of carcinogens was first discovered in 1775 by an English physician named Sir Percival Potts. He found that chimney sweepers had a high percentage of skin tumors caused by soot coming in contact with skin tissue. Since then, over 500 chemicals have been found to be carcinogenic. "Many years ago, environmental cancer was a problem associated only with certain occupations. Now we are all exposed to certain amounts of carcinogens in our everyday living."

Scientists constantly are testing chemicals on laboratory animals to learn what substances, either singly or with other chemicals, are carcinogenic. Once a chemical is known to be a cancer producer, every possible step is taken to remove it from man's exposure. That action is not always possible, as in the case of ultraviolet rays, cosmic radiation, and naturally occurring radioactive isotopes.

One of the most important things an individual can do to protect himself from cancer is to keep his weight within normal ranges. Cancer most often strikes those who allow themselves too much food and too little exercise.

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## A Feeling of Responsibility

A LABORER for a construction company stepped into some wild shrubbery bordering New York Highway 19 while helping to repair the highway recently. He was bitten in the left leg by a rattlesnake. In the "remedy" section of his report, the inspector wrote laconically, "If possible, determine if presence of poisonous snakes is characteristic of area in which work is to be performed and caution employees."

—From New York State Department of Labor News.